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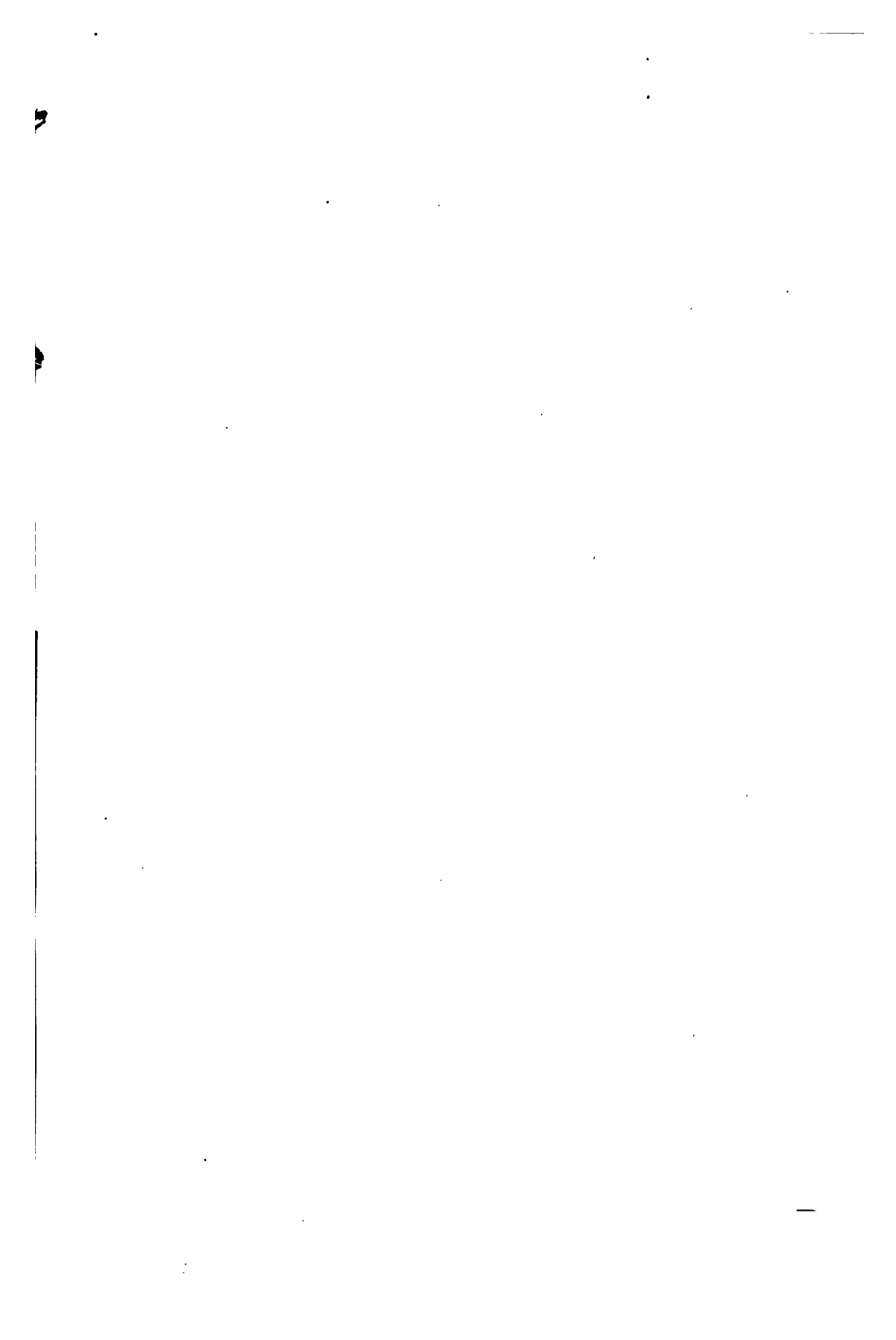
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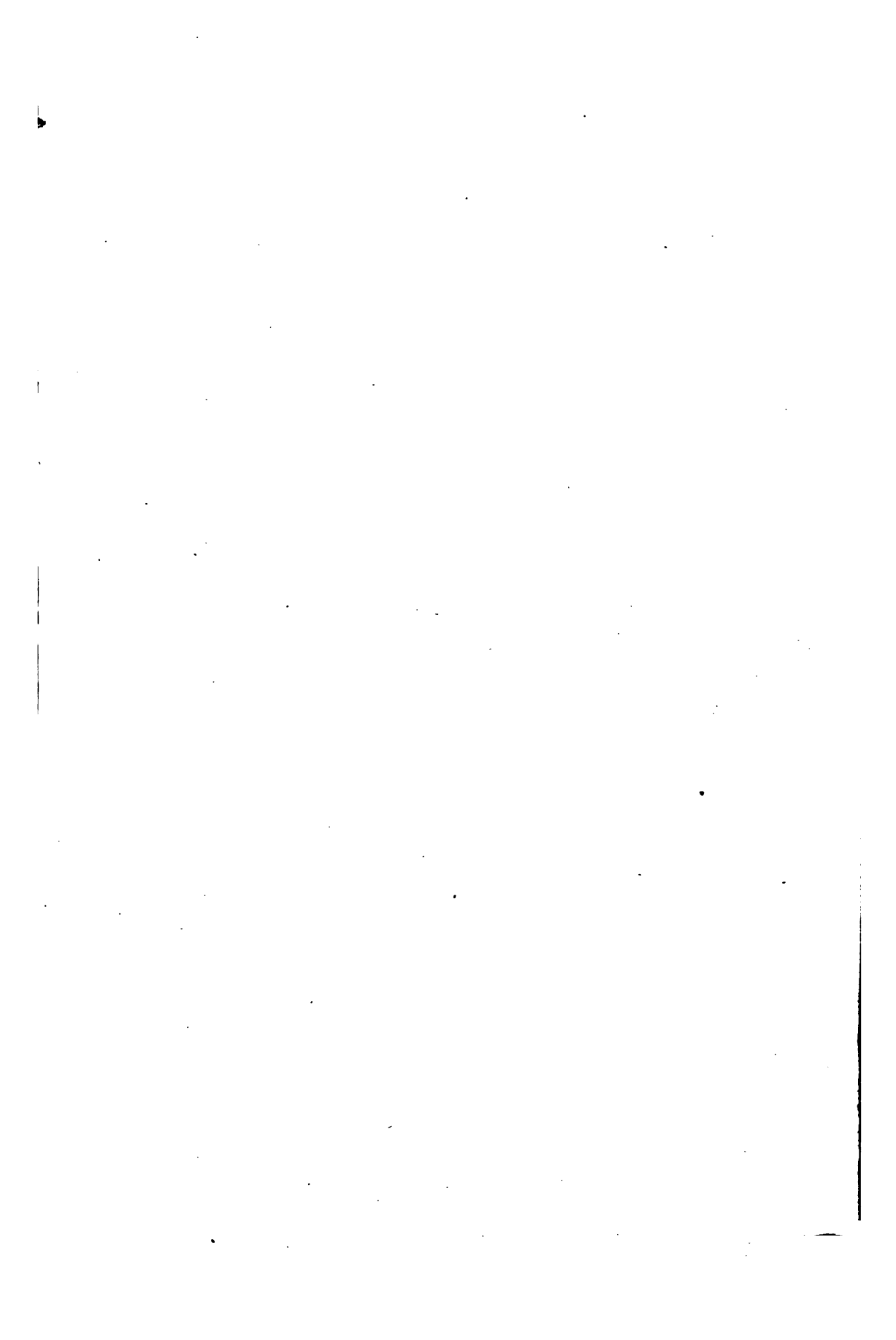
COAST PILOT NOTES ON HAWAIIAN ISLANDS

SECOND EDITION

AUGUST 15, 1909



WASHINGTON
GOVERNMENT PRINTING OFFICE
1909



U.S. - Pacific oceanic survey

DEPARTMENT OF COMMERCE

COAST AND GEODETIC SURVEY

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NOTE.

The courses and bearings given in degrees are *true*, reading clockwise from 0° at north to 360° , and are followed by the equivalent *magnetic* value in points in parentheses.

Distances and velocities of currents are in *nautical miles*.

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DEPARTMENT OF COMMERCE,
U. S. COAST AND GEODETIC SURVEY,
Washington, D. C., August 15, 1919.

The information contained in this publication relates to the Hawaiian Islands, and the islands and reefs westward to Midway Islands. It is a compilation from surveys by the U. S. Coast and Geodetic Survey; United States Hydrographic Office publication No. 115, The Hawaiian Islands and the Islands, Rocks, and Shoals to the westward; surveys by the Hawaiian Government Survey and United States Geological Survey; and the results of special investigations in 1911 by E. Vance Miller, nautical expert, the compiler, under the direction of J. J. Gilbert, assistant, U. S. Coast and Geodetic Survey, inspector of hydrography and topography.

Great courtesy has been shown by local authorities and masters and pilots navigating these waters in furnishing information for use in this publication.

Navigators are requested to notify the Superintendent of the U. S. Coast and Geodetic Survey of any errors or omissions they may find in this publication, or of additional matter which they think should be inserted for the information of mariners.

E. LESTER JONES,
Superintendent.

HAWAIIAN ISLANDS, AND THE ISLANDS, ROCKS, AND SHOALS WESTWARD.

INTRODUCTION.

This volume covers the islands of Hawaii, Maui, Kahoolawe, Lanai, Molokai, Oahu, Kauai, and Niihau, and several smaller ones.

The Hawaiian Islands lie between the parallels $19^{\circ} 00'$ and $22^{\circ} 15'$ N latitude and $155^{\circ} 00'$ and $162^{\circ} 00'$ W longitude, extending in a general northwest by west direction for a distance of about 350 miles. The islands are of volcanic formation. The highest mountains are on Hawaii and Maui, the greatest elevation being Mauna Kea, 13,825 feet, on Hawaii. There are many fertile valleys, and on the coasts there generally more or less narrow strips of lowland from which the higher land rises abruptly at a short distance inland.

The hydrographic features are similar to the topographic features above mentioned. In general there is a narrow bank of soundings close inshore, from the edge of which the bottom pitches off rapidly to great depths. The reefs and shoals generally show in the daytime either by breakers or a difference in the color of the water over them.

RIVERS.—There are several hundred streams, some of which are of good size, but none are navigable, except for small boats.

POPULATION.—By the census of 1910, the islands had a population 191,874 inhabitants.

PRODUCTS.—Agriculture is the principal occupation of the inhabitants. Sugar, rice, coffee, and pineapples are the great staples, and vegetables and tropical fruits are also cultivated. Cattle and sheep are raised to some extent.

TRADE.—The principal trade is with the United States. In 1918 the total imports amounted to about \$50,000,000, and total exports \$81,000,000. The principal imports are iron, steel, and lumber products, cloths and provisions; the principal exports are sugar, pineapples, rice, bananas, and fruits.

The port of entry is Honolulu; the subports are Hilo and Mahukona, Hawaii; Kahului, Maui; and Koloa, Kauai.

WHARVES AND LIGHTERS.—At Honolulu, Hilo, and Kahului, there are wharves at which vessels can lie to discharge and load. At all other ports vessels discharge or load either by lighters or wire cable.

STANDARD TIME.—The standard time of the Hawaiian Islands is $157^{\circ} 30'$ west longitude time.

CLIMATE.—The Hawaiian Islands lie within the Tropics, but the heat is tempered by the sea breezes and the islands are generally healthy. The mean monthly temperature at Honolulu varies from about 70.5° to 76.8° in January and July, respectively.

WINDS.—The Hawaiian Islands lie within the limits of the strong northeast trades, which prevail for eight or nine months of the year. They begin early in March, blowing well from the northward until May and from then until October they are more easterly. During the trades frequent calms and light variable winds may be found for several miles to leeward of the larger islands.

During October the trades are light with frequent calms and occasionally a west-southwest swell sets in causing anchorages on the lee side of the islands to be more or less uncomfortable.

During November and December the trades are strong and variable, occasionally being interrupted by light southerly winds.

During January and February southerly and southwesterly gales often prevail. These winds are known as konas and they are generally from a few hours to two or three days duration, followed by rain. During the konas all anchorages on the lee side of the islands are unsafe.

Along the west coast of Hawaii and the south coast of Maui the land and sea breezes are very regular, the wind blowing on shore during the day and off shore at night.

In general, November and February are the most stormy months, December and January often being fair, although stormy weather may occur at any time during the winter season. Fair weather may be expected during May, June, September, and October.

RAINFALL.—The rainfall in the Hawaiian Islands varies greatly for different localities. From observations made at different stations it is found that the amount of rainfall often varies greatly at the same station for the same months in different years, or for the total rainfall of different years. The greatest rainfall is always found on the windward side of the islands. November and February have the greatest rainfall. In general the winter and early spring is the rainy season although there is some rain in July.

Fog does not occur around the islands and except for rain squalls, mists, and haze, there is no thick weather. The mountains on the islands, however, are often obscured by clouds.

AIDS TO NAVIGATION.—Some of the prominent points and the principal harbors are marked by lighthouses, and some of the principal dangers by buoys.

ANCHORAGES are numerous, except on the northerly and easterly sides of the islands, the first requirement under ordinary conditions being shelter from the trade winds. During kona weather most of the anchorages on the southerly and westerly sides of the islands are unsafe.

PILOTAGE is compulsory for certain vessels. There are pilots at the principal ports who come off in small boats to vessels making signal outside the entrance.

TOWBOATS.—There are no seagoing towboats in the islands. The local steamers do towing. In some of the harbors there are large launches which sometimes assist lighters and vessels when inside.

HARBOR CONTROL.—A harbor master is appointed for each of the harbors of Honolulu, Hilo, and Kahului, and they have charge of the anchorage and berthing of vessels in their respective harbors.

SUPPLIES.—Provisions, ice, lumber, and some ship-chandler's stores can be obtained at Honolulu, Hilo, and Kahului. Some provisions can be obtained at other places.

WATER can be conveniently obtained at Honolulu, Hilo, and Kahului. Water can be obtained also from streams at many places.

FUEL.—Coal and fuel oil (for vessels) can be obtained at Honolulu, Hilo, and Kahului.

REPAIRS.—There are machine shops at Honolulu, Hilo, and Kahului, and ordinary repairs to machinery can be made. There is a floating dry dock with a dead-weight capacity of 4,500 tons at Honolulu.

COMMUNICATION with San Francisco, Vancouver, Auckland, Sydney, Yokohama, and Hongkong may be had by several regular lines of steamers which touch at Honolulu. There is also a line of steamers to Seattle and Tacoma and another to the Isthmus of Tehuantepec via San Francisco. There is frequent communication by inter-island vessels around the islands.

RAILROADS.—A railroad skirts the shores of Oahu westward from Honolulu along the southwesterly and northwesterly sides and half-way down the northeasterly side. Railroads extend southward and southeastward from Hilo. Railroads also extend a short distance northeastward, southward, and northwestward from Kahului.

HIGHWAYS.—There are good highways in many parts of the islands, and carriages or automobiles can be obtained at most of the towns.

CABLE.—There is communication by cable to San Francisco and to Manila via Midway and Guam. There is good telephone service on all the large islands.

WIRELESS TELEGRAPH.—There is wireless telegraph communication between the islands.

QUARANTINE.—National quarantine laws are enforced in the islands by officers of the United States Public Health Service.

MARINE HOSPITAL.—There is a relief station of Class II of the United States Public Health Service at Honolulu.

CURRENTS.—The currents are, as a rule, greatly influenced by the direction and strength of the trade winds. In general, there is a westerly set, due to the prevailing northeasterly trade winds; they are, however, subject to much variation, both in force and direction, at different seasons, without appearing to be influenced by the winds or to follow any general law.

TIDAL CURRENTS.—The tidal currents seem to have but little influence and are not generally taken into consideration.

HAWAII,

the largest of the islands, is at the southeast end of the group. It is triangular in shape and has a greatest length of 81 miles north and south and a greatest width of 73 miles. The interior of the island is mountainous and rugged, and the domes of **Mauna Loa** and **Mauna Kea**, 20 miles apart, are each nearly 14,000 feet high; in the central western part Mount Hualalai rises to an altitude of a little over 8,000 feet. There is much fertile land along the east side of the island and down the southeast side as far as the Kau district; from here around Kalae (South Cape) and up the west coast there is but little vegetation.

RIVERS.—There are numerous streams on the east coast, but none are navigable except for boats and small craft. The southeast and west coasts have no streams that reach the sea.

POPULATION.—By the census of 1910 Hawaii had 55,382 inhabitants.

WINDS.—The easterly trade winds seem to divide at Cape Kumukahi, part following the coast northwestward around Upolu Point, where it loses its force, the other part following the southeast coast around Kalae, where it loses its force. On the west coast of Hawaii the sea breeze sets in about 9 a. m. and continues until after sundown, when the land breeze then springs up. Vessels from westward bound to ports on the windward side of Hawaii should pass close to Upolu

Point and keep near the coast, as the wind is generally much lighter than off shore. Sailing vessels from westward bound to ports on the eastern side of Hawaii should keep well northward until clear of Alenuihaha Channel.

RAINFALL.—The rainfall in Hawaii varies greatly in different localities. The greatest amount is found along the windward side and on the western highlands, while very little reaches the southeasterly coast, and practically none reaches the west coast.

ANCHORAGES are numerous except on the northeast and southeast coasts, the first requirement under ordinary conditions being shelter from the northeast trades

SUPPLIES.—Provisions, ice, lumber, and some ship chandler's stores can be obtained at Hilo. Some provisions can be obtained at other places.

WATER can be conveniently obtained at Hilo.

COAL and fuel oil for vessels can be obtained at Hilo.

REPAIRS.—There is a machine shop at Hilo, where vessels can make extensive repairs.

COMMUNICATION with Honolulu by a regular line of steamers can be had several times a week.

RAILROADS extend southeastward and southward from Hilo. There is a railroad that follows the coast from Mahukona around the north end of the island to within 1 mile of Akoko Point.

HIGHWAYS.—There are good highways in many parts of the island, and carriages can be obtained at most of the towns.

TELEPHONE.—There is communication by telephone to all parts of the island and by wireless telegraph to the other islands.

CURRENTS.—Generally the currents follow the trades, but occasionally they set against the wind. A current follows the coast north of Cape Kumukahi around Upolu Point; another one follows the trend of the coast off shore southwestward from Cape Kumukahi around Kalae and northward as far as Upolu Point. There is an inshore current that sets southward from Okoe Landing along the west coast around Kalae, and thence northeastward along the shore as far as Keauhou.

NORTHEAST COAST OF HAWAII.

From Upolu Point to Cape Kumukahi, a distance of 80 miles, the coast has a general southeasterly trend; it is only partially surveyed, but is generally bold. The only known outlying dangers are shoals off Kauhola Point and Blonde Reef in Hilo Bay, and all other dangers will be avoided by giving the coast a berth of about 2 miles.

There are no harbors or sheltered anchorages on this coast except Hilo Bay. At the various landings the freight is handled by local vessels, and at most of the landings vessels load by means of a wire cable.

When running the coast at night, it will be found that the electric lights of the various sugar mills define the coast fairly well.

Upolu Point, the northernmost point of Hawaii, is hard to identify. There are numerous bluffs, forming headlands, in the vicinity, all of which are quite similar from seaward. The bluff at Upolu Point is a little higher than the others. The country back of the point is covered with sugar cane, and here and there may be seen clumps of trees, among which are generally situated the mills, camps, and villages.

Union Mill, 4 miles southeastward of Upolu Point and 1 mile inland, is prominent.

Kauhola Point, 7 miles eastward of Upolu Point, is a low point of land marked by a light, off which a dangerous reef, generally marked by breakers, extends 1 mile. Vessels should give this point a berth of 2 miles. A fair anchorage, used by local vessels, can be had in 9 fathoms, with Kauhola Point light bearing 88° true (E by N mag.), distant 1 mile. In leaving this anchorage, bound eastward, steer 10° true (N mag.) for 2 miles clear the reef.

Akokoa Point, 3 miles eastward of Kauhola Point, marks the easterly limits of the sugar plantations. Eastward of this point the country has the appearance of a large table-land, rising gradually to the Kohala Mountains, which are heavily wooded to their summits.

The coast between Akokoa Point and Waipio Gulch, a distance of about 10 miles, consists of numerous precipices, from 1,000 to 2,000 feet high, and deep gorges that extend back into the country. There are also numerous waterfalls. The faces of the precipices present a general brownish appearance, although in places they are covered with vegetation from the top to the sea.

Between Waimanu and Waipio Gulches, a distance of about 3 miles, is a table-land about 2,000 feet high, surrounded on all sides by gulches.

From Waipio Gulch southeastward the precipices become lower, until, at Kukuihaele Landing, 2 miles distant, the coast is a comparatively low bluff about 300 feet high, which height is rarely exceeded between this point and Hilo.

Between Waipio Gulch and Hilo the country to an elevation of about 2,000 feet is covered with sugar cane. Beyond this, extending upward toward Mauna Kea, it is wooded to an elevation of about 2,600 feet, and from here up the mountains present a barren appearance.

Waipio Gulch, about 10 miles southeastward of Akokoa Point, is deep and prominent. There is a small village at its mouth. A fair anchorage can be found in 10 to 15 fathoms $\frac{1}{2}$ mile offshore and midway between the village and Pacific mill, which is located on the point about 2 miles eastward of the village. This anchorage is well sheltered from southerly winds, and even easterly winds do not blow strong.

Kukuihaele Landing, on the outer point, 2 miles eastward of Waipio Gulch, is the landing for Pacific mill. Kukuihaele light marks the end of the point.

Honokaa Landing, 5 miles southeastward of Kukuihaele Landing, is marked by several buildings on the bluff. Southeastward and close to the landing is a high bridge over a deep gulch. A mill is located 1 mile southward of the landing.

Paauhau Landing, 2 miles southeastward of Honokaa, is marked by the white masonry of the inclined railway which leads from the landing to the top of the bluff. A mill is situated on the lowland south of the landing. A deep gulch makes in on each side of the mill. The southern one is spanned by a bridge.

Paaulio is a village about 5 miles southeastward of Paauhau and 1 mile inland. A gray church with red roof and gray steeple is prominent.

Hamakua mill is 5 miles southeastward of Paauhau.

Koholalele Landing, $5\frac{1}{2}$ miles southeastward of Paauhau, is marked by a building at the top of the bluff and by another one halfway down. This landing is difficult to pick up.

Kukaiau mill is about $\frac{3}{4}$ mile southeastward of Koholalele. An inclined railway leads from a house on top of the bluff to a derrick at its foot. The bluffs are higher and more thickly covered with vegetation than those northwestward.

Ookala mill, $3\frac{1}{2}$ miles southeastward of Kukaiau mill, is on the edge of the bluff on the south side of a deep gulch.

Laupahoehoe Point, marked by a light, and 3 miles southeastward of Ookala mill, is low and flat and makes out about $\frac{1}{4}$ mile from a deep gulch. The seaward end of the point is a mass of black lava rock. A reef, over which the sea generally breaks, extends about $\frac{1}{4}$ mile offshore. Laupahoehoe village is located on the inshore end of the point. There is a coconut grove between the village and the end of the point, and one on the north side of the mouth of the gulch. A church, painted yellow, with a green roof and a square yellow tower, is prominent. A mill is located on the edge of the bluff about $1\frac{1}{4}$ miles southeastward of the point. There is a large waterfall and several smaller ones near the mill.

Hakalau Bay, about $8\frac{1}{2}$ miles southeastward of Laupahoehoe Point, lies in the mouth of Hakalau Gulch. A large mill is on the lowland in the gulch. The bluffs between Hakalau Bay and Alia Point become much lower, and the country is less cut up and presents a more level appearance.

Honomu mill, about $2\frac{1}{4}$ miles southeastward of Hakalau Bay, is situated in the mouth of a gulch. About 2 miles northward of Pepeekeo Point the waterfalls cease to be a characteristic of the coast.

Alia Point, $1\frac{3}{4}$ miles southeastward of Honomu mill, is not very prominent.

Pepeekeo Point, marked by a light, is about $2\frac{1}{2}$ miles southward of Honomu mill. It is the most prominent point in the vicinity. Pepeekeo mill is located on the bluff south of the point.

Hilo Bay is described below.

Keokea Point, about 3 miles eastward of Hilo, is low and hard to distinguish from other points in the vicinity. There are a few coconut trees on the point.

Leleiwi Point, 5 miles eastward of Hilo, is marked by a mass of bare, black lava rock about 20 feet high, which extends 100 yards seaward from the tree line. The coast between Hilo and Leleiwi Point is low and covered with a dense growth of pandanus and guava trees, back of which is a low, heavily wooded flat plain. The shore is broken by low patches of black lava.

Olaa mill, $6\frac{1}{2}$ miles southward of Leleiwi Point and $3\frac{1}{2}$ miles inland, is prominent. At night the electric lights of the mill can be seen some distance at sea. Between Olaa mill and Cape Kumukahi the land is low and level and is wooded for a distance of about 2 miles from the shore. Beyond this the Olaa plantation rises to an elevation of about 2,000 feet, back of which may be seen the forests.

The coast between Leleiwi Point and Cape Kumukahi, a distance of about 17 miles, is a series of low bluffs. The lava flow of 1840, which reaches the sea 5 miles northwestward of Cape Kumukahi, is marked on its seaward end by two black hills about 50 feet high,

which lie close together. This lava flow is visible inshore for a distance of about 5 miles. The plain northwestward of the cape is thickly covered with foliage and scattered coconut groves.

Cape Kumukahi, the easternmost cape of Hawaii, is a low mass of bare, black lava with a jagged top, and is clearly defined from all sides. The end of the point is marked by a group of sharply defined pinnacles which are only visible when close inshore. A series of old blowholes, or craters, begin 2 miles southwestward of the cape and extend 5 miles in a southwesterly direction. The blowhole nearest the point is surmounted by a grove of coconut trees.

The trade winds divide at the cape, part following the coast northwestward and the other part following the coast southwestward; sailing vessels should therefore give the cape a berth of about 2 miles in rounding it.

HILO BAY,

about 60 miles southeastward of Upolu Point and 20 miles northwestward of Cape Kumukahi, is included between Keokea Point on the south and Pepeekeo Point on the north, a distance of 7 miles, and indents the coast about 3 miles. It is the leading commercial port of the island and is frequented by both steam and sailing vessels. The bay is partially sheltered by Blonde Reef from the prevailing northeast trades, although there is frequently a heavy swell which interferes with the handling of cargo. It is exposed to north winds, which generally do not blow very strong. The westerly shore of the bay is bluff, while the southerly and easterly shores are low.

Hilo, the second in commercial importance and population of the cities of the Hawaiian Islands, is situated on the southwesterly side of the bay.

From Hilo eastward along the beach numerous houses are scattered as far as Waiakea, a small town near the mouth of Waiakea Creek.

The railroad wharf has a depth of 21 feet alongside. There is a landing for lighters in Waiakea Creek.

PROMINENT FEATURES.—Hilo Sugar Company's mill, about 1 mile northward of Hilo, is painted gray and has one large black stack. At the water's edge just southward of the mill is a high white stone abutment with a white derrick on it. When the mill is in operation at night, it will be recognized by the number of electric lights that are scattered about the plant. **Green (Halai) Hill**, 1 mile southwestward of Hilo, is the highest point in the vicinity; it is covered with sugar cane and a few scattered trees; on the north side below the summit is a depression resembling a crater. The Roman Catholic church in Hilo has two square towers with windows on all sides, surmounted by smaller conical towers, all painted gray. The native church, southward of the Catholic church, is yellow with a red roof, surmounted on its northerly end by a tall, square, yellow tower with red roof. East of the line joining the above-mentioned churches are two small steeples; the one near the water front is a square white tower surmounted by a steeple, and the other similar in appearance except that it is faced with yellow and has a red roof.

RANGES.—The native church tower when seen between the two towers of the Roman Catholic church bearing 200° true (S by W mag.) leads clear of Blonde Reef. This range is difficult to pick up by a stranger. A lighted range marks the channel south of Blonde Reef to the railroad wharf in Kuhio Bay.

PILOTAGE is not compulsory, but vessels without coasting license are required to pay half fee when a pilot is not taken. The pilot rate is \$1.50 per foot draft.

TOWBOATS.—A small towboat and several launches do towing. The small freight steamers of the interisland service also do towing when required.

ANCHORAGE can be had in the bay anywhere under the lee of Blonde Reef in from 5 to 7 fathoms, and vessels drawing 15 feet or less can anchor close under Cocoanut Island, where it is generally smooth. After heavy rains a strong current setting northward from Waiakea Creek is felt in the southeasterly part of the bay.

HARBOR REGULATIONS.—The harbor master, who is also the pilot, has charge of the anchorages.

SUPPLIES.—Provisions, ice, lumber, and some ship chandler's stores, as well as fuel oil and coal for steamers, can be obtained, and water from hydrants on the railroad wharf.

REPAIRS.—There is a machine shop, where extensive repairs can be made.

WINDS.—The prevailing winds are the northeast trades. At night a gentle breeze generally comes off the land.

TIDES.—The mean range of tides is 1.8 feet.

SAILING DIRECTIONS, HILO BAY.

FROM EASTWARD.—Give Leleiwi Point a berth of 1 mile in rounding it and steer 280° true ($W \frac{1}{8} N$ mag.) for $4\frac{1}{2}$ miles, heading for Paukaa light until $\frac{1}{2}$ to $\frac{3}{4}$ mile from shore; then steer 184° true ($S \frac{1}{2} E$ mag.) keeping this distance offshore and taking care to pass westward of Blonde Reef gas and bell buoy. Anchor southward of the black can buoys, marking the southwesterly edge of Blonde Reef, with the Hilo Sugar Company's mill bearing 279° true (W mag.), in 7 to 8 fathoms. Or, if bound for the railroad wharf in Kuhio Bay, after passing Blonde Reef gas and bell buoy haul eastward slowly, leaving black buoy (can, 3) to port. Then steer 97° true ($E \frac{1}{8} N$ mag.) with Kuhio Bay Range Lights ahead. Pass between the buoys marking the edges of the shoals on each side of the channel. In 1918 this channel had been dredged to 33 feet. There is 34 to 40 feet along the wharf.

FROM NORTHWARD.—After rounding Pepeekeo Point steer 184° true ($S \frac{1}{2} E$ mag.), keeping $\frac{1}{2}$ to $\frac{3}{4}$ mile offshore and taking care to pass westward of Blonde Reef gas and bell buoy, anchor as directed in the preceding paragraph.

DANGERS.—The lead is generally a good guide on the south side of the bay, but the shoaling is abrupt to Blonde Reef and the reefs around and eastward of Cocoanut Island.

Blonde Reef is an extensive sunken reef, with depths of 1 to 3 or 4 fathoms, which extends $1\frac{1}{2}$ miles in a west-northwesterly direction from the easterly side of the bay. The shoaling is generally abrupt on all sides of the reef, and the lead can not be depended on to clear it. It is marked at its westerly end by a black gas and bell buoy, and on its southwesterly edge by two black can buoys. A breakwater is under construction from the easterly shore over Blonde Reef to its westerly end. The entrance to the bay is $\frac{3}{4}$ mile wide between Blonde Reef and the westerly shore. There is no safe passage across the reef.

Cocoanut Island (wooded) and the bare islets northward are connected with the shore by a reef, which makes out 150 to 200 yards on all sides of them. The north end of the reef is marked by a buoy (nun, red, No. 2), and the west side by a buoy (spar, black, No. 5).

Shoals with 7 to 15 feet extend out a distance of $\frac{1}{8}$ to $\frac{1}{4}$ mile all along the southerly side of the bay.

SOUTHEAST COAST OF HAWAII.

From Cape Kumukahi to Kalae (South Cape), a distance of about 63 miles, the coast has a general southwesterly trend; it is not surveyed but is generally bold, and it is advisable for vessels to keep about 1 mile off shore.

There are no sheltered harbors or anchorages on this coast that afford shelter during all winds. Punaluu and Honuapo are the only landings where the local steamers call.

The country southwest of Cape Kumukahi is heavily wooded and along the beach are numerous coconut groves. The shore in the vicinity of the cape is low, growing higher southwestward. The rocks are of black lava formation. The characteristic features of this coast are the lava flows, which reach from the hills to the water's edge; they present a bare and rough appearance.

The old blowholes, or craters, heretofore mentioned as extending southwestward from the cape, join the ridge which forms the divide between the Puna and Kau districts.

Pohoiki Landing, 4 miles southwestward of Cape Kumukahi, is marked by a prominent coffee mill. There is a thick mass of green foliage on a small point in front of the mill.

Honuaula Crater, about 5 miles southwestward of Cape Kumukahi and 3 miles inland, has its southeast side blown out and its southerly side covered with vegetation; it is quite prominent.

Opihikao village, about 7 miles southwestward from Cape Kumukahi, is marked by a prominent bare yellow mound, about 80 feet high, near the beach about 1 mile northeastward of the village. The village is situated in a coconut grove. In the village are two churches with steeples, about $\frac{1}{8}$ mile apart.

Kalapana village, 7 miles southwestward of Opihikao and on the northeasterly side of a bold flat-topped headland, the most prominent point in this vicinity, is situated on low ground back of a sand beach. In front of the village and near the beach is a church with a steeple. About $\frac{1}{4}$ mile northeastward of the village is a thick grove of pandanus trees. When coasting from southwestward the village will not be seen until almost abeam.

Kahaulea village, $2\frac{1}{2}$ miles southwestward of Kalapana, consists of a few scattered houses between which are coconut trees.

The prominent and thickly wooded point 1 mile southwestward of Kahaulea village marks the end of the vegetation along the shore in the vicinity.

Keauhou Landing, is 13 miles southwestward of Kahaulea. At this point the bluffs are yellow, steeper, and near the beach. The plain at the foot of the bluffs is low and on a dark night the beach is hard to see. About 2 miles southwestward of Keauhou is a yellow bluff about 300 feet high at its northeasterly end. This is the most prominent landmark near the beach on this part of the coast.

Between the prominent point 1 mile southwestward of Kahaualea and Keauhou the plain along the shore and the lower slopes of the mountains are devoid of vegetation; higher up the mountains are wooded. Beginning at a point about 10 miles east of Keauhou the coast consists of bluffs several hundred feet high, continuing to a point about 3 miles southwestward of the landing. The bluffs are marked by numerous lava flows and are quite bare, with the exception of three clumps of trees near the northeasterly end.

The volcano of Kilauea can not be seen from seaward but its location can be told approximately, in the day time, by the smoke which it discharges, and at night by the glare on the clouds, when active.

Kau Desert is the country southward of the volcano and is devoid of vegetation. The lava flow of 1823 from Mauna Loa marks the western limits of the desert. A sharply defined low black cone is located about 5 miles inland and on the easterly side of the lava flow of 1823, at an elevation of about 1,800 feet.

Pahala mill, about 4 miles northward of Punaluu and 3 miles from the coast, is prominent. The country in the vicinity of the mill is covered with sugar cane to an elevation of about 2,000 feet; beyond this it is wooded up the mountain side to within about 6,000 feet of its summit. Here and there bare lava flows cut up the cane fields.

Punaluu Landing, about 17 miles southwestward of Keauhou, is marked by a large warehouse close to shore. There is a church with a steeple on the steep slope near the beach on the west side of the anchorage. A small village located in a coconut grove lies in the mouth of the deepest gorge. The local steamer calls here. A plantation railroad runs from the landing to Pahala mill. Back of the landing up to an elevation of about 3,500 feet the slopes are broken, above this they are regular and gradual to the summit of Mauna Loa.

Enuhe Butte, about 3 miles northwestward of Punaluu, is a cone about 700 feet high with its flat top tilted seaward and covered with sugar cane; its sides are covered with vegetation. The top of the cone, which appears to set at an angle to the slope on which it rests, has an elevation of about 2,327 feet.

Kaumaikēohu Peak, about 5 miles northward of Punaluu, is a prominent cone situated within the forest line.

Honuapo Landing, $4\frac{1}{2}$ miles southwestward of Punaluu, is marked by a wharf which has a long low building at its inshore end. The local steamer calls here. Back of the landing is a mill and westward, near the beach, is the village. Some of the slopes back of the landing are covered with sugar cane. A white stone pyramid about 15 feet high stands on the lava point eastward of the landing.

Between Punaluu and Honuapo the shore is composed of masses of black lava rock, which project out into deep water. There are two conspicuous lava flows which run down to the beach northeastward of Honuapo, one about 2 miles and the larger one 4 miles from the landing.

Kipaepae Hill, $3\frac{1}{2}$ miles southwestward of Honuapo and $\frac{1}{2}$ mile inland, is 465 feet high. It is surmounted by a black lava monument.

Kamilo Point, about 8 miles southwestward of Honuapo, is a low, dark lava mass, on which is a black lava monument with a square base, surmounted by a dome. A reef, over which the sea generally breaks, extends about $\frac{1}{4}$ mile off the point.

. **Kaalualu Bay**, about 1 mile westward of Kamilo Point, affords good shelter for small craft during northeast trades, but is exposed during kona weather. With the easterly entrance point bearing 88° true (E by N mag.), distant about 200 yards, anchorage may be had in about 10 fathoms. Between the anchorage and the landing, which is in the northeast part of the bay, are several submerged coral reefs, which should be avoided, especially when there is a heavy swell.

Between Honuapo and Kalae (South Cape) the country is bare and rolling and gently slopes down to the cape.

Kalae (South Cape), 5 miles southwestward of Kaalualu Bay, is low and brown and marked by a light. The southeasterly side is low, while the westerly side begins with a low bluff at the point and rises gently northward for a distance of 2 miles to **Mamalu Pali**, which is 500 or 600 feet high and extends 5 or 6 miles inland. On account of the current, which sets northeastward against the trade winds, it is generally rough on the easterly side of the cape.

WEST COAST OF HAWAII.

From Kalae (South Cape) to Upolu Point, a distance of about 98 miles, the coast has a general northerly trend. It is only partially surveyed, but is generally bold. The largest outlying reef, about $\frac{1}{2}$ mile wide, is in Kawaihae Bay. Off the numerous capes and points the reefs do not make out over $\frac{1}{4}$ mile, and all dangers may be avoided by giving the coast a berth of about 1 mile.

There are no harbors or anchorages on this coast that afford shelter during all winds although they are all smooth during the regular northeast trades, but exposed during kona weather.

The trade winds draw around Kalae and hold northward offshore for about 3 miles, generally causing a rough sea. Close inshore the sea is generally smooth.

That section of the coast which lies between Kalae and Kawaihae Bay, 75 miles northward, is known as the Kona coast.

The country along this coast is broken up by numerous lava flows varying in length from a few hundred yards to 30 miles, that have broken out from Mauna Loa and Mount Hualalai and carried destruction with them on their way to the sea. Between these flows there are sections of country which are heavily wooded and covered with vegetation above an elevation of 1,500 feet, and there are large areas covered with sugar cane and coffee. Below the 1,500-foot level there is very little vegetation. Many of the lava flows reach the coast and terminate in bluffs, and between them along the beach will be seen trees and other vegetation.

At an elevation of 2,000 feet the kona region is known for its cool and bracing climate, and rain is plentiful. Little variation in weather conditions is experienced, there generally being a land and sea breeze, except during kona winds. This condition, however, does not apply between Kawaihae Bay and Upolu Point, since it is affected by the winds which draw across the island.

From a point 2 miles northward of Kalae, where Manalu Pali turns inland toward Mount Akihi, to Hanamalo Point there is a low plain several miles wide, which rises gradually to the mountains.

Pele Hills are a group of cones near the beach 12 miles northwestward of Kalae. These cones are prominent landmarks, and at the summit of the highest one is a black stone pyramid.

Okoe Landing, locally known as **Kapua**, is situated on a cove immediately southward of **Hanamalo Point**. The cove indents the shore more than any other in the vicinity, and shows a little more sand on the beach and three of four small houses. Anchorage can be had in 7 to 15 fathoms, sandy bottom.

Hanamalo Point, about 22 miles northwestward of **Kalae**, is a low mass of lava, and on account of having no characteristic features, is difficult to distinguish from other points in the vicinity unless close inshore.

The current divides at this point, one part following the coast around **Kalae** and thence northeastward along the shore, losing its strength in the vicinity of **Keauhou**. Offshore, on the southeast coast, the current sets southwestward. North of **Hanamalo Point** the current sets northward, and vessels have been known to drift between 1 and 2 miles an hour during calms.

Milolii village, 2 miles northward of **Hanamalo Point**, is marked by a church with steeple, in the southerly end of the village, and a number of houses which are situated in and around a coconut grove. In front of the village there are several strips of sand beach.

Hoopuloa Landing, $2\frac{1}{2}$ miles northward of **Hanamalo Point**, is marked by a white flagpole in the rear of the village and by a road which zigzags up the mountain. The village is located in a coconut grove.

Along the coast in the vicinity may be seen jagged black masses of lava at the foot of the bluffs along the beach. Above the steep lava slopes, which are characteristic of this section of the coast, there is a heavily wooded table-land from which rises the dome of **Mauna Loa**.

Lepeomoa Rock, $8\frac{1}{2}$ miles northward of **Hoopuloa**, is located at the water's edge; it is the ruin of an old crater and is crescent shaped, with its seaward face blown out. The rock is about 150 feet high.

Kauhako Bay, about $2\frac{1}{2}$ miles northward of **Lepeomoa Rock**, is marked at its head by a pali, or cliff, which is about $\frac{1}{2}$ mile long and about 150 feet high at its southerly end. The bay is a slight indentation in the coast, and the village of **Hookena** is located on the lowland in front of the northerly end of the pali. A church with steeple is a prominent landmark in the northerly end of the village. There is a large grove of coconut and shade trees near the village. Anchorage can be found in 15 fathoms, sandy bottom, about 300 yards off the village.

Honaunau Bay, 3 miles northward of **Kauhako Bay**, is marked on its southeasterly side by a church with a steeple. The entrance points are low black lava. A few houses are northward of the church and there is a coconut grove southward. About 1 mile back of the bay, on the upper slopes, are three or four large tobacco warehouses.

Kealakekua Bay, 3 miles northward of **Honaunau Bay**, is marked on its northerly side by a light on **Cook Point**. It is about 2 miles wide between **Keaweakehaka Point** and **Palemano Point** and indents the coast about 1 mile. It is free of obstructions, affords good anchorage in all but strong southwesterly winds, and is by far the best anchorage on this coast. A narrow reef fringes the shore between the southerly end of the cliff and **Palemano Point**. The shore of the bay is low, except on the northeast side, where there is a precipitous cliff between 400 and 600 feet high and about $\frac{1}{2}$ mile long. **Kaawaloa Cove** is the northerly part of the bay and lies between the high cliff and **Cook Point**.

The villages of **Napoopoo** and **Kealakekua** consist of a few houses scattered along the beach among the coconut trees just southward of the cliff. Provisions can be obtained in limited quantities; fresh water is scarce. The landing is in the middle of the village alongside of a low shed, but during a heavy swell it is best to land on the sand beach either at the north end of the village or the one southward. **Cook's Monument** is a concrete shaft, 25 feet high, located near the shore on the inner side of Cook Point.

Approaching **Kealakekua Bay** from either direction a vessel will be enabled to pick it up by heading for the dome of **Mauna Loa** on the bearing 90° true (E $\frac{7}{8}$ N mag.); a 33° true (NNE mag.) course, heading for the middle of the cliff, will lead into the bay. Good anchorage can be found in 10 to 15 fathoms, with the south end of the cliff bearing 55° true (NE mag.) and **Cook's Monument** bearing 314° true (NW by W mag.).

Palemano Point, on the south side at the entrance to **Kealakekua Bay**, is low and flat with a coconut grove near its end. About $\frac{3}{8}$ mile northward of the point an old lava flow makes down to the beach; this flow is about $\frac{3}{8}$ mile wide.

Keawekaheka Point, on the north side at the entrance to **Kealakekua Bay**, is a low, bare, lava point. An extensive lava flow reaches from the point to the high cliff in the bay.

Puu Ohau is a green cone about 230 feet high, located near the beach, about $1\frac{1}{2}$ miles northward of **Keawekaheka Point**; it has a blowhole in the middle and its seaward side is blown out.

Keikiwaha Point, $2\frac{1}{4}$ miles northward of **Keawekaheka Point**, is low, black, and jagged with coconut trees on it. Behind the point the mountain side is covered with cane to an elevation of about 1,000 feet.

Keauhou Bay, $2\frac{1}{2}$ miles northward of **Keikiwaha Point**, is a small indentation in the coast, lying between two lava flows at the foot of a gentle slope which has coconut trees on it near its base and algaroba trees just above them. There is an indifferent anchorage, but it is not recommended. The boat landing is on the northeasterly side of the bay, in the vicinity of which are a few houses.

Mount Hualalai, in the central western part of **Hawaii**, is a conical peak, 8,269 feet high, covered with vegetation to its summit, and is prominent from any point of approach. Its western slope terminates in a bare, lava plain about 4 miles wide which forms a low beach consisting of sand in some places and lava rock in others.

Kailua Bay, 5 miles northward of **Keauhou Bay**, is marked on its northerly side by a red light. It is a small indentation in the coast at the southerly end of the flat plain that extends northwestward to **Kawaihae Bay**. The bay affords good anchorage except during kona weather. The landing is on the northerly side of the bay alongside a small wharf with a shed on it. **Kailua** village is situated along the shore of the bay and next to **Hilo** is the most important town on the island. Provisions and water can be obtained in limited quantities. A prominent gray church with red roof surmounted by a tower with red steeple stands about 100 yards from shore in the northerly part of the town.

APPROACHING FROM SEAWARD, steer for **Mount Hualalai** on a 66° true (NE by E mag.) course; the town will be ahead and will be rec-

ognized by the red roofs on the houses which stand out conspicuously against the green background. When off the entrance to the bayhead for the church described in the preceding paragraph on a 33° (NNE, mag.) course, and anchor in 10 fathoms, sandy bottom.

Keahole Point, 7 miles northwestward of Kailua Bay, is the westernmost point of Hawaii. It is marked by Keahole light. The point is prominent, low, and well defined, and consists of black lava. A shoal makes off the point for about $\frac{1}{4}$ mile.

Mount Waawaa, 5 miles northward of Mount Hualalai, is prominent, about 3,800 feet high, and can often be seen when Mount Hualalai is hidden by the clouds. It is dome-shaped, with deep gorges in its sides, and rises about 500 feet above the slope on which it stands.

Kuili Hill, 5 miles northward of Keahole Point and $\frac{1}{4}$ mile inland, is a brown crater, 346 feet high, which marks the seaward end of a series of blowholes that are on the ridge on the northwesterly slope of Mount Hualalai.

Between Keahole Point and Kawaihae Bay there are several small bays, which are not used.

The coast between Kailua Bay and Kawaihae Bay is a black, jagged mass of lava, with numerous capes and indentations made up by numerous lava flows over the level country. The lava flow of 1859, which reaches the sea south of Kawaihae Bay, marks the northern limits of the lava flows.

Between Keahole Point and Upolu Point the trade winds draw over the mountains, at times causing a very strong offshore wind. Vessels that anchor in this vicinity should be prepared to use both anchors.

Kawaihae Bay, 22 miles northward of Keahole Point, is an open bight, and is marked on its northerly side by Kawaihae light. The bay affords good anchorage for vessels of any size, except during kona weather, about $\frac{3}{8}$ mile offshore, in 7 to 8 fathoms, with Kawaihae light bearing anything eastward of 66° true (NE by E mag.). A reef about $\frac{1}{2}$ mile wide and bare in places fringes the beach in front of the village, and it should be approached with caution, as the sea generally does not break over it during offshore winds. The landing is alongside of a wharf with an open shed on it in front of the village. The latter consists of a few houses scattered along the beach about $\frac{1}{4}$ mile southward of the light.

PROMINENT FEATURES.—About 200 yards eastward of the light is a gray, one-story keeper's dwelling, with red roof. Between the light and dwelling is a white stone beacon and a wireless-telegraph mast. About $\frac{1}{2}$ mile northward of the village is the mouth of a deep gulch that divides into two branches near its head. The mouth of the gulch is thickly wooded, and 100 yards southeastward is a conspicuous white rock at the southeasterly edge of a dark bluff. About $\frac{3}{4}$ mile southward of the village is the foundation of the ancient temple of Kamehameha. It is a square of dark rock located on a low mound near the beach, and is visible from the anchorage.

APPROACHING KAWAIHAE BAY FROM NORTHWARD, when within 2 miles of the beach head for Kawaihae light on a 89° true (E by N mag.) course, and select anchorage as described in a preceding paragraph.

APPROACHING FROM SOUTHWARD, head for the mouth of the deep gorge $\frac{1}{2}$ mile northward of the village on a 55° true (NE mag.) course until Kawaihae light bears 89° true (E by N mag.).

Mahukona Anchorage is an open bight 10 miles northward of Kawaihae Bay, and is marked on its southerly side by Mahukona light. On account of the fresh offshore winds in this vicinity vessels should anchor with plenty of chain and have a second anchor ready to let go. A current generally sets northward past the anchorage. The landing is in front of the village, alongside of a wharf with a house on it. There are several mooring buoys off the landing in 7 to 10 fathoms. Mahukona consists of a few houses located in an algaroba grove near the beach, and is the terminus of a plantation railroad that goes around the northerly end of the island as far as Akoko Point, affording transportation for the Kohala sugar district.

PROMINENT FEATURES.—Mahukona range lights (fixed red), maintained by private parties, lead to the outer mooring buoys on a 77° true (ENE mag.) course. There are two conspicuous white conical towers, each 15 feet high, one on the southerly side of Makaohule Point and one about 400 yards southward of the boat landing between Mahukona light and the beach. About $\frac{1}{4}$ mile northward of the beacon on Makaohule Point is a stone railroad embankment about 30 feet high and 50 feet long.

ANCHORAGE can be found in 10 fathoms just northward of the outer mooring buoys, but in no case should vessels anchor southward of them, as the bottom is very foul. Vessels intending to moor to the buoys should use exceptionally strong lines, and also be prepared to let both anchors go if necessary. An anchorage where the wind does not blow so strong can be found $\frac{1}{2}$ mile northward of the landing and about 400 yards off the railroad embankment. The local pilot will moor vessels if desired.

SUPPLIES.—Provisions, coal, and water can be obtained in limited quantities.

Honoipu Anchorage, 4 miles northward of Mahukona, is an open bight, and is marked by a large white building situated about 75 feet above the water on the edge of the bluff. Southward of the white building is a large red mill. There are several mooring buoys close inshore, and vessels moored to them can have their cargo handled directly by means of a steam winch on shore. Anchorage can be found in 8 to 10 fathoms, with the seaward end of the wharf bearing 78° true (ENE mag.) and the cable house bearing 122° true (ESE mag.).

The coast between Mahukona and Upolu Point is a series of low, black bluffs, back of which the country is marked by numerous old blowholes and rises gently to the Kohala Mountains.

Alenuihaha Channel lies between the islands of Hawaii and Maui, and is 26 miles wide in its narrowest part between Upolu Point, Hawaii, and Kailio Point, Maui. It is free from obstructions and has bold water close to shore.

During strong trade winds the channel is quite rough, and a current of from 1 to 2 knots sets westward; but during the calms that frequently follow there is at times an easterly set of about 1 knot, which during kona winds may reach a velocity of 2 or 3 knots. The channel is roughest and the current strongest when the wind is between north-northeast and east-northeast.

MAUI,

the second in size of the islands, lies 26 miles northwestward of Hawaii. It is about 42 miles long in a westerly direction and about 23 miles wide, and consists of two distinct mountain masses joined by a low flat isthmus.

The extinct crater of **Haleakala** 10,032 feet high, is near the center of the eastern peninsula. On the northwesterly side of the crater the land slopes gently, while on the southerly and easterly sides it is much steeper and in some places precipitous. **Koolau Gap** on the northerly side and **Kaupo Gap** on the southeasterly side are two large openings in the side of the crater.

Mount Kukui, 5,788 feet high, is near the center of the western peninsula. This peninsula is cut up by rugged peaks and deep valleys and gulches, which open out in sloping plains that extend to the coast.

RIVERS.—There are numerous streams emptying into the sea, none of which are navigable except for small boats.

POPULATION.—By the census of 1910, Maui had 28,623 inhabitants.

WINDS.—The trade winds divide at **Kauiki Head**, part following the trend of the coast northwesterly as far as the isthmus when it again divides, part of it drawing southward, often reaching great force in the vicinity of **Maalaea Bay**. Another part follows the trend of the coast around the northwesterly end of Maui and through **Pailolo Channel**; the wind blows with greater force on the **Molokai** side of the channel. From **Kauiki Head** the wind follows the trend of the south shore of Maui through **Alalakeiki Channel** around the northerly end of **Kahoolawe**, but is not felt on the westerly shore of that island. On the south coast of Maui a sea breeze sets in about 9 a. m. and continues until after sundown, when the land breeze then springs up. Light airs or calms are generally found in the vicinity of **Molokini**.

RAINFALL.—There is quite a heavy rainfall on the weather side, while on the lee side there is not nearly as much.

ANCHORAGES are numerous on the southwesterly side of Maui, the first requirement under ordinary conditions being shelter from the trade winds.

SUPPLIES.—Provisions, water, coal, fuel oil, and some ship chandler's stores can be obtained at **Kahului**. Some provisions can be obtained at other places.

REPAIRS.—There is a machine shop at **Kahului** where minor repairs can be made.

COMMUNICATION is frequent with **Honolulu**.

RAILROADS.—Railroads extend a short distance northeastward, southward, and northwestward from **Kahului**.

HIGHWAYS.—There are good highways in many parts of the island, and carriages can be obtained at most of the towns.

TELEPHONE.—There is communication by telephone to all parts of the island and by wireless telegraph to the other islands.

CURRENTS.—Generally the currents set with the trades. A current follows the north shore of Maui westward from **Kauiki Head** and draws down through **Pailolo Channel**; the current is stronger on the **Molokai** side of the channel. A strong current follows the coast southward of **Kauiki Head** until past **Kahoolawe**. It is said that a slight current sets southeastward in **Alalakeiki Channel**. In the vicinity of **Lahaina** the current generally sets northwestward.

Pueokahi (Hana) Bay is about $\frac{3}{8}$ mile in diameter and is included between Nanualele Point on the north and Kauiki Head on the south. The northerly and westerly shores are low, while the southerly shore is high. The landing is on the southwesterly side of the bay, near which are two warehouses. The bay does not afford a desirable anchorage and is of little commercial importance, but with local knowledge small steamers enter to discharge or load. The anchorage used by the small local steamers is inside Kauiki Head in the southwesterly part of the bay, and is marked by a mooring buoy to which vessels make their stern lines fast. This anchorage is about 200 yards wide, with depths of 14 to 36 feet; it is exposed to northeast winds and sea, and during strong southwesterly blows the wind comes offshore in such heavy squalls that vessels are apt to drag. In the absence of local knowledge this anchorage should not be attempted by anything but small craft. A more exposed anchorage for deeper draft vessels can be found in 9 to 10 fathoms about midway between Kauiki Head and Nanualele Point, with Outer Pinnacle Rock showing between Twin Rocks, bearing 151° true (SE $\frac{1}{2}$ S mag.), and the sugar mill bearing 217° true (SSW $\frac{3}{8}$ W mag.).

Nanualele Point is the low, flat, coral point on the north side of Pueokahi Bay.

Haula Hill, 540 feet high, is the highest of a group of five hills lying $\frac{1}{2}$ mile westward of the landing. The sugar mill and plantation buildings $\frac{1}{4}$ mile southwestward of the landing are conspicuous.

Kauiki Head, the easternmost point of Maui, is an extinct crater, about 400 feet high, joined to the mainland by a low neck of land, and from a distance appears as an island. Close to the northerly side of Kauiki Head is an islet on which is located Kauiki Head light; two black rocks and a rock awash lie near the northwesterly side of the islet.

Twin Rocks are two bare rocks with deep water close to, lying about 300 yards northeastward of Kauiki Head light; the inner rock is 20 feet and the outer rock 14 feet high.

Inner Pinnacle Rock, about 3 feet high lies 200 yards southward of Outer Twin Rock.

Outer Pinnacle Rock, about 5 feet high, lies 300 yards southeastward of Outer Twin Rock.

A shoal about 250 yards in diameter and with 4 to 6 feet over it lies northward of the channel and about 400 yards northwestward of Kauiki Head light.

The land near the coast is covered with cane for a distance of about 4 miles on each side of the mill.

The coast between Kauiki Head and Nuu Anchorage consists of high, rough bluffs, broken up by numerous small capes and indentations, and is covered with vegetation as far as Kaupo Gap. The entire south face of Haleakala is steep and corroded and presents a reddish-brown appearance, dotted here and there with green patches. The slopes become less steep as the shore is approached.

Alau Island, $1\frac{1}{2}$ miles southward of Kauiki Head and $\frac{3}{8}$ mile offshore, is about 100 yards in diameter and 100 feet high, and is grass covered. Between the island and the mainland there is an extensive reef. Two rocks, with about 6 feet over them, lie close together, about $\frac{3}{4}$ mile southeastward of the island. Vessels should give the island a berth of about $1\frac{1}{2}$ miles in passing.

Kepuhi Point, $\frac{3}{4}$ mile southward of Alau Island, is marked by a conspicuous mill near the water's edge. The plantation has been abandoned. About 3 miles southward of Alau Island there is a white church and dwelling standing on a bluff about 150 feet high.

Kipahulu Gulch, $5\frac{1}{2}$ miles southwestward of Kepuhi Point, has precipitous sides and runs well into the rim of Haleakala Crater. Between the gulch and the sea is a plantation. The mill and village are situated about 1 mile from the shore. Back of the mill can be seen a railroad trestle. An indifferent anchorage, good for small vessels only, can be found in 8 fathoms, sandy bottom, westward of Ahole Rock and off the whitewashed shed at the boat landing. This anchorage is exposed and a heavy swell generally sets in. A light is established at Kipahulu.

Kailio Point, about 5 miles west-southwestward of Kipahulu Gulch, is a narrow point about $\frac{1}{4}$ mile long and 75 feet high, and is on the east side of the entrance to a shoal bight which is about 1 mile wide. An anchorage, partially protected from the trade winds, can be found inside the point about 200 yards offshore, in 10 to 12 fathoms, sandy bottom.

Apole Point, $1\frac{3}{4}$ miles westward of Kailio Point, is low and is composed of black jagged rock.

Nuu Anchorage, about $2\frac{1}{4}$ miles westward of Kailio Point and immediately westward of Apole Point, is in the bight which lies northward of the first large lava flow westward of Kaupo Gap, and is marked by a white storehouse on the beach. Anchorage can be found in 8 fathoms, sandy bottom, with the white storehouse bearing 45° true (NE $\frac{7}{8}$ N mag.) distant about 400 yards.

Lualailua Mountains, 7 miles westward of Nuu Anchorage and 2 miles inland, are a group of red mounds about 2,000 feet high.

Hokukano Cone, 1 mile west-southwestward of Lualailua Mountains, is a conspicuous red cone with a lava flow which reaches the sea in a high black mass.

Pimoe Dome, $2\frac{1}{4}$ miles westward of Hokukano Cone, is red and irregular, with its easterly side broken; it is the crater from which the large fan-shaped lava flow in the vicinity of Pohakueaea Point had its origin.

Cape Hanamanioa, the southwesterly end of the island, is a black lava mass.

Keoneio (La Perouse) Bay, lies between Cape Hanamanioa and Cape Kinau. It is about $\frac{1}{2}$ mile wide and indents the coast about $\frac{1}{2}$ mile, and is marked on its northwest side, at the water's edge, by **Kanaloa Crater**, a low, yellowish-brown cone with its seaward side blown out. This crater is surrounded by a lava flow which has come down from **Lapa Crater**, a small black cone about 1 mile northward of the bay. There is a small settlement at the foot of Kanaloa Crater. There is a rock with 10 feet over it in the middle of the entrance to the bay, and the bottom is rocky; it is not recommended for strangers.

There are no harbors or anchorages between Nuu Anchorage and Keoneio Bay, and the country back of this section of the coast is bare, with practically no signs of habitation.

Danger.—A pinnacle rock with less than 12 feet over it is said to exist somewhere between Pohakueaea Point and Keoneio Bay, within $\frac{1}{2}$ mile of shore. It may be off Pohakueaea Point as an extension of the lava flow that forms the point.

Cape Kinau, is on the northerly side of Keoneio Bay, and is a long, low, black lava point. A rock with $4\frac{1}{2}$ feet over it lies 400 yards 276° true ($W\ \frac{3}{8}\ S$ mag.) of the light.

Olai Hill, $2\frac{1}{4}$ miles northward of Kanahena Point, is the most prominent landmark in this vicinity. It is brown in color, about 360 feet high, and consists of three knolls.

Molokini, marked by a light, lies $2\frac{1}{2}$ miles 263° true ($WSW\ \frac{1}{2}\ W$ mag.) of Olai Hill.

Makena Anchorage, 1 mile northward of Olai Hill, is exposed to kona weather, but affords good holding ground in 10 fathoms with the brownstone church bearing 123° true (ESE mag.) and the boat landing bearing 85° true ($ENE\ \frac{5}{8}\ E$ mag.). The boat landing is $\frac{1}{4}$ mile northward of the church, alongside of a shed on the southerly side of the most prominent point in the vicinity.

There is a group of houses back of the landing, southeastward of which is a thick algaroba grove. The country back of Makena rises gently to the mountains; the lower slopes are covered with cactus, while higher up it is thickly wooded.

From Makena to Kihei the coast has a general northerly trend; it is low and thickly covered with algaroba trees. The country back of this section of the coast is the same as that in the vicinity of Makena.

Keawakapu Anchorage, 4 miles north of Olai Hill, is marked by a large wharf extending offshore in a southwesterly direction.

Maalaea Bay is the large bight in the middle of the southwesterly coast of Maui; its shores are low and sandy and lined with algaroba trees. The isthmus and the slopes on either side are covered with sugar cane and other vegetation. On account of the fresh winds that sweep across the isthmus during the trade winds and the fresh southerly winds during the konas the bay is a poor anchorage.

A reef fringes the shore for a distance of about $3\frac{1}{2}$ miles southward of Kihei. Off Kalepolepo, where the reef is widest, there is a 14-foot spot at its outer end, lying $\frac{1}{2}$ mile from shore, which is marked by a buoy (can, red and black horizontal stripes). Strangers should pass outside of the buoy. Broken ground, with a least depth of 3 fathoms, lies about $\frac{3}{4}$ mile west-southwestward of Kihei wharf, and is marked by a buoy (can, red and black horizontal stripes).

Kihei Anchorage, 9 miles northward of Olai Hill, is marked by a sugar mill and plantation settlement. There is a wharf, with a depth of 6 feet at its end, near the mill. A white oil tank and a tall chimney are located north-northeastward from the wharf at a distance of $\frac{1}{8}$ and $\frac{3}{8}$ mile, respectively. Anchorage can be found in 5 fathoms near the mooring buoys about $\frac{1}{2}$ mile off the wharf.

McGregor Point, marked by a light, is on the westerly side of Maalaea Bay. There is a boat landing here.

The coast between McGregor Point and Olowalu is broken by low bluffs rising from the water's edge, behind which the country presents a barren appearance. The mountains are surmounted by sharp jagged peaks and cut up by deep gorges.

Olowalu Anchorage, 5 miles west-northwestward of McGregor Point, is marked by a mill, which is close to the beach near a clump of trees. There is a small wharf, for lighters, near the mill. Vessels can anchor close inshore off the mill.

Lahaina Anchorage, 5 miles northwestward of Olowalu, is marked by a light. It is a good anchorage, and is generally calm except

during kona weather. Lahaina village is scattered along the beach among the trees. It is the distributing center for this part of the island. The boat landing is alongside of a wharf with a warehouse on it at the southerly end of a row of white houses that extend along the beach.

PROMINENT OBJECTS.—In the center of the town is a church with a tall brown tower. Lahaina light is prominent on the northerly side of the inshore end of the wharf. A short distance southeastward of the landing is a tall white flagpole in front of the courthouse. At the northwesterly end of the town, on Puunoa Point, is a tall white wireless-telegraph pole. Back of the town can be seen several tall stacks, which are on the sugar mills and pumping stations.

ANCHORAGE.—In approaching Lahaina vessels should keep about 1 mile offshore until the wharf or light bears 55° true (NE. mag.), and then head in on this course until up to Lahaina gas buoy, then anchor in 10 to 12 fathoms.

DANGERS.—A reef, over which the sea generally breaks, fringes the shore in front of the town and for several miles, on each side. There is a boat passage through the reef in line with Lahaina Buoy light and the end of the wharf.

BREAKWATER.—There is a small breakwater, parallel to the shore, on the southeasterly side of the landing, which affords shelter for a boat during any kind of weather.

SUPPLIES.—Provisions and some ship chandlery can be obtained. Water can be obtained in barrels.

The coast from Lahaina to Kekaa Point is low, back of which the country is planted in sugar cane.

Kekaa Point, $3\frac{1}{2}$ miles northward of Lahaina, is the extreme western point of the island, and is the most prominent landmark in the vicinity. The point is a dark rock, 75 feet high and 300 yards long, and from a distance looks like a detached rock. There is a conspicuous white tomb on top of the rock.

The coast from Kekaa Point to Lipoa Point consists of a series of low bluffs and stretches of sand beaches, along which may be seen numerous clumps of algaroba trees. So far as known, this section of the coast has no outlying dangers. The country slopes gently, is more or less cut up by shallow gulches, presents a brownish appearance, and is covered with short grass.

Kaanapali Landing, on the northerly side of Kekaa Point, is marked by a red warehouse and a white oil tank, which are just inside the sand beach.

Kaanapali is the terminus of a plantation railroad which handles most of the sugar from this district. The boat landing is alongside of a wharf which has derricks on it. Off the end of the wharf are several mooring buoys. Good anchorage can be found in 10 to 20 fathoms about $\frac{1}{4}$ mile off the wharf in the vicinity of the mooring buoys.

Napili Bay, $4\frac{1}{2}$ miles northward of Kekaa Point, is a small bight between two coral reefs, where an anchorage can be found about $\frac{1}{2}$ mile offshore in 5 fathoms. It is seldom used.

Hawea Point, 5 miles northward of Kekaa Point, is marked by Hawea Point light.

Honolua Bay, about 1 mile northward of Napili Bay, is the open bight lying between Hawea Point and Lipoa Point. A fair anchorage can be found for small vessels southward of Lipoa Point. The boat

landing is at the head of the bay, and is well protected from the northeast trades.

In the vicinity of **Lipoa Point** the bluffs along the northern shore of Maui become higher and more precipitous, and are more cut up by bights and headlands. The country is more rolling and cut by deeper gulches. The mountains are steeper and greener and near their tops are wooded in places. Patches of black rocks that show above water are found close inshore off several of the points in the vicinity. Vessels should give these rocks a berth of $\frac{1}{2}$ mile.

Kanounou Point, about 2 miles east-northeastward of Lipoa Point, has several bare black rocks a short distance offshore.

Nakalele Point, about 3 miles east-northeastward of Lipoa Point, is marked by Nakalele Head light. There are several bare black rocks off the point.

Puu Koae (Sugar Loaf), 3 miles east-southeastward of Nakalele Head light, is a dark, bare, conical mound, 638 feet high, marking the seaward end of one of the numerous ridges that end abruptly at the sea. Close to Puu Koae and just eastward, on the end of the same ridge, is a low and more rounded dome. There is deep water close to Puu Koae. A rock awash lies in the cove between Puu Koae and Mokeehia.

Mokeehia Rock, $1\frac{1}{2}$ miles southeastward of Puu Koae, is a large bare rock on the outer end of Hakuhee Point, and from a distance it looks like an island. Large caverns can be seen in the face of the cliffs on both sides of the rock. About 3 miles southeastward of Mokeehia Rock is a reef that extends about $\frac{3}{4}$ mile offshore, and is marked by Waihee Reef gas buoy, which is moored in a depth of 18 fathoms about 1 mile offshore.

The country between Mokeehia Rock and Pauwela Point, about 9 miles east-northeastward of Kahului, is covered with sugar cane.

Waihee Valley, $2\frac{1}{2}$ miles southeastward of Mokeehia Rock, is deep and has precipitous sides. It is covered with verdure and is quite prominent.

Iao Valley is deep, with steep sides, and is also covered with verdure, and it is said some of the finest scenery in the islands is to be found here. The town of **Wailuku** lies in the mouth of the valley. Wailuku is connected with Kahului by railroad.

Kahului Harbor, about $6\frac{1}{4}$ miles southeastward of Mokeehia Rock, is an indentation between two coral reefs, and is about $\frac{1}{2}$ mile wide at its entrance, contracting to about $\frac{1}{4}$ mile at the anchorage, and is $\frac{3}{4}$ mile long. It is the leading commercial port of the island, and is frequented by both steam and sailing vessels.

The harbor affords good anchorage at all times, except when the wind is from north to northwest, at which times a heavy swell sets in, and vessels are sometimes forced to put to sea. The shores of the harbor are low and sandy. On the northeasterly side the harbor is protected by a breakwater which extends in a west-northwesterly direction out to American Girl Rock, and has deep water near its end. There is a light on the breakwater at its outer end. A breakwater is under construction on the west side of the harbor.

Kahului is situated on the southeasterly shore of the bay, and is the distributing port for this section of the island.

WHARVES.—There is a depth of 21 feet alongside the railroad wharf. Northeastward is the wharf where the lighters discharge.

PROMINENT FEATURES.—Three large white oil tanks on the easterly side of the harbor near the beach are conspicuous, and back of them are the railroad shops and warehouses. Puunene mill, about $1\frac{1}{2}$ miles southeastward of Kahului, is conspicuous. Between Kahului and Wailuku are a number of high sand dunes.

RANGE.—Kahului Harbor range lights are the guide to the anchorage on a $162^{\circ} 30'$ true (SSE $\frac{1}{2}$ E mag.) course.

PILOTAGE is not compulsory, but vessels without a coasting license are required to pay half fee when a pilot is not taken.

TOWBOATS.—There is a small towboat in the harbor. The regular mail steamers from Honolulu will also do towing.

ANCHORAGE can be found west-southwestward of the outer end of the breakwater in 6 to 7 fathoms, with the outer end of the railroad wharf bearing 135° true (SE $\frac{1}{8}$ E mag.), distant about $\frac{3}{8}$ mile. Vessels should have both anchors ready to let go, and stern lines ready for making fast to mooring buoys.

DANGERS.—A shoal, over which the sea usually breaks, extends about 700 yards from the western shore, and at its widest point, near the anchorage, it is marked by a buoy (nun, red, No. 2).

SUPPLIES.—Provisions, fresh water, and some ship chandlers' stores, as well as fuel oil can be obtained.

REPAIRS.—There is a machine shop where minor repairs can be made.

WINDS.—The prevailing winds are the northeast trades, and they frequently blow with great force across the isthmus.

REEF.—A reef about $\frac{3}{4}$ mile wide begins at the easterly entrance to Kahului Harbor and fringes the coast in an east-northeasterly direction until almost up to Pauwela Point, which is marked by a light. It is marked at its widest point by Spartan Reef can buoy (black, No. 1), which lies about $3\frac{1}{4}$ miles northeastward of the breakwater at Kahului and $1\frac{1}{4}$ miles from shore.

The coast between Kahului Harbor and Pauwela Point light is low, and the country back of it is covered with sugar cane.

From Pauwela Point to Nahiku, a distance of about 15 miles, the bluffs become higher, in many places reaching heights of between 300 and 400 feet. Eastward of Nahiku the bluffs become gradually lower, and when Kauiki Head is reached they are low. Sugar cane ceases to be a characteristic feature of the coast after passing Pauwela Point until within about 5 miles of Kauiki Head. The country is green, and the higher slopes are heavily wooded. It is cut up by numerous gulches, and on account of the heavy rains numerous waterfalls empty into the sea.

Between Pauwela Point and Kauiki Head there are a number of rocks close inshore, but by keeping 1 mile offshore all dangers will be avoided.

Keanae Point, 12 miles east-southeastward of Pauwela Point, is low and is marked on its westerly side by a stone church with a steeple. There are a few houses and clusters of trees on the end of the point. The landing is marked by a derrick. Small vessels can anchor in 8 fathoms close inshore immediately westward of the point. This anchorage should not be attempted without local knowledge, as there are some sunken rocks on the easterly side in the bight. There is weekly communication with Honolulu.

Keanae Valley, just eastward of Keanae Point, is the largest and most prominent valley on this part of the island. It leads inland toward the crater of Haleakala. Three high rocks close inshore form the most prominent landmarks in this vicinity.

Wai o Kilo Anchorage is in 9 fathoms, sandy bottom, about midway between Pauwalu Point and the bight at Wailua and about 400 yards offshore. This is a fair anchorage when the wind is between south and southwest.

Aluea Rock lies about $\frac{1}{4}$ mile offshore and about the same distance southward of Wai o Kilo Anchorage.

Nahiku Anchorage, $2\frac{1}{2}$ miles southeastward of Pauwalu Point, is in the open bight off Nahiku, in 7 fathoms, close inshore. Strangers should not attempt this anchorage, as there are two sunken rocks near shore. There is a small settlement southeastward of the anchorage.

Alalakeiki Channel, between Maui and Kahoolawe, is about 6 miles wide and clear of dangers, with the exception of Molokini, which is marked by a light. The trade winds draw through the channel, hauling around the north end of Kahoolawe. The trades blow with much force at the easterly entrance to the channel, but in the vicinity of Molokini it is generally calm. The currents are variable, and should not be depended upon.

Molokini, lying in the middle of the northerly end of Alalakeiki Channel, is a small, barren, crescent-shaped, rocky island 154 feet high, with the opening northwestward. A reef makes off about 300 yards northward from the northwesterly end of the island. There is deep water close to the island. It is marked by a light.

KAHOOLAWE,

the eighth in size of the islands, lies 6 miles southwestward of the southwesterly end of Maui. It is about 9 miles long and 6 miles wide. The island presents an even and unbroken appearance. **Mount Moaula**, a brown dome 1,450 feet high, near the easterly end of the island, is the highest point and the most prominent landmark. There are no streams or springs on the island. In general, the island presents a very desolate and barren appearance, and is of but little commercial importance. There are no outlying dangers except the shoal off its westerly point.

The southerly side consists of a high table-land which terminates in a high bluff at the beach. From **Kealaikahiki Point**, the extreme westerly point of the island, for about 2 miles southeastward the shore is low and flat. A shoal with a least depth of 1 fathom extends 1 mile westward of Kealaikahiki Point, and vessels should give the point a berth of at least $1\frac{1}{2}$ miles in rounding. An anchorage and landing can be found in **Smuggler Cove** about 1 mile southeastward of the point.

The northwesterly coast consists of low bluffs, from which the land slopes gently upward. About 2 miles southwestward of the extreme northerly point of the island are a few buildings on the easterly side of a small cove. There is an anchorage and landing here for small craft.

The easterly coast consists of very high bluffs, in some places rising straight up from the water's edge for several hundred feet. An in-

different anchorage for small craft can be found in the southerly part of **Kanapou Bay** near the middle of **Beck Cove** and about $\frac{1}{4}$ mile from its head in 6 to 7 fathoms.

Kealaikahiki (way to Tahiti) Channel lies between **Kahoolawe** and **Lanai** and is about 15 miles wide. So far as known it is free from obstructions. Sailing vessels should avoid this channel during trade winds, as long periods of calms sometimes occur southward and westward of **Kahoolawe** and **Lanai**.

Anau Channel lies between **Maui** and **Lanai** and is about 8 miles wide. With the exception of a reef about 3 miles long, which extends from $\frac{1}{2}$ to 1 mile offshore northward of **Wahapuu Point**, **Lanai**, the channel is free from obstructions. During trade winds it is often calm in the channel.

LANAI,

the sixth in size of the islands, lies about 8 miles westward of west **Maui** and the same distance southward of the easterly end of **Molokai**. It is about 15 miles long in a northwesterly direction and about 10 miles wide near its southeasterly end, gradually narrowing toward its northwesterly end. The highest point is **Mount Palawai**, 3,400 feet high, located in the southeasterly part of the island. The slopes on the easterly side of the mountain are steep and cut up by deep gulches, while those on the westerly side are more gradual, terminating in a rolling plain. On account of the scarcity of rain there is a very limited supply of water on the island. In general, the island presents a barren appearance. It is devoted entirely to stock raising. The census of 1910 gave **Lanai** a population of 131 inhabitants.

From **Wahapuu Point**, the easternmost point of **Lanai**, for a distance of about 4 miles southwestward the coast is low and sandy, it then begins to rise and when within 2 miles of **Manele Bay** it becomes a series of very high bluffs and continues so until **Manele Bay** is reached.

Manele Bay, on the southerly side of the island, is marked on its westerly side by **Paupehe Rock**. The bay is about $\frac{1}{4}$ mile wide and indents the coast about $\frac{1}{4}$ mile and is used as an anchorage by small local steamers. There is a boat landing at the head of the bay. There are several detached bare rocks on both sides of the bay near shore.

Paupehe Rock is a high, bare, brown rock separated from the shore by a low, sand spit. It is the most prominent landmark along this section of the coast.

From **Manele Bay** to **Cape Kaea**, the southwestly point of the island, the coast consists of low bluffs, behind which the land rises in steep slopes to the table-land above.

From **Cape Kaea** northward to **Kaena Point** the coast is a series of high, precipitous bluffs, in some places between 300 and 400 feet high.

Kaumalapu Harbor, about $3\frac{1}{2}$ miles northward of **Cape Kaea**, is a small bight at the mouth of the most prominent gulch in the vicinity, affording an indifferent anchorage for small coasting vessels.

Five Needles are about $5\frac{1}{2}$ miles northward of **Cape Kaea** and about the middle of the bight on the westerly side of the island. They are a group of detached pinnacle rocks about 120 feet high, lying close inshore just northward of **Honopu**. On account of the high bluffs behind them these rocks are difficult to see from offshore.

Kaena Point is low and rocky and hard to distinguish from the other points in the vicinity. It is said that a shoal extends about $\frac{1}{4}$ mile offshore in this vicinity.

From Kaena Point eastward the bluffs along the coast gradually become lower and within a few miles are only a few feet high and show sand beaches here and there. Back of the low section of the beach there is generally a narrow low strip of land which rises gently to the table-land.

Maunalei village, about 10 miles eastward of Kaena Point, consists of a few houses located on the lowland on the easterly side of the island; there is an abandoned wharf here. There is a reef about 3 miles long and extending from $\frac{1}{2}$ to 1 mile offshore between Maunalei village and Wahapuu Point.

Pailolo Channel, between Maui and Molokai, is about $7\frac{1}{2}$ miles wide, and is clear of obstructions with the exception of Mokuhooniki and Kanaha Rock, near the easterly end of Molokai, and a reef about $\frac{3}{4}$ mile wide which fringes the shore of Molokai. Kamalo Point Reef gas buoy marks the edge of the reef off the southeasterly point of Molokai.

Kalohi Channel lies between Lanai and Molokai and is about 8 miles wide. With the exception of a reef about $\frac{3}{4}$ mile wide, which fringes the shore of Molokai, the channel is free from dangers.

MOLOKAI,

the fifth in size of the islands, lies $7\frac{1}{2}$ miles northwestward of Maui and 8 miles northward of Lanai. It is more or less rectangular in shape and is about 34 miles long in a westerly direction and about 7 miles wide.

The easterly end is mountainous, its summit being **Kamakou Peak**, 4,970 feet high. On the northerly side the mountain slopes are very steep, in many places being almost perpendicular, and there are numerous deep gorges with precipitous sides. On the southerly side the slopes are gradual, cut up with gorges, and terminate in a narrow strip of rolling land near the coast. On the westerly side the land slopes gently, is cut up by gulches, and here and there an extinct crater can be seen.

About 10 miles from the westerly end of the island the plain is only a few hundred feet high and is marked here and there by prominent blow-holes.

The entire westerly end of the island is a bare table-land cut up by small gulches, and rising gradually to **Mount Nana**, 1,382 feet high. From seaward this part of the island presents a smooth and rolling appearance.

RIVERS.—There are numerous streams emptying into the sea at the easterly end of the island, none of which are navigable.

POPULATION.—By the census of 1910, Molokai had 1,791 inhabitants.

WINDS.—The trade winds divide at Cape Halawa, part following the north shore and another part following the south shore. During a heavy easterly sea it is apt to be quite choppy off this point and vessels should give it a berth of about $1\frac{1}{2}$ miles in rounding.

RAINFALL.—There is a very heavy rainfall on the northerly side, while on the southerly side there is not nearly as much.

ANCHORAGE.—There are few anchorages, none of which are sheltered from all winds.

COMMUNICATION with Honolulu can be had by steamer and wireless telegraph, and supplies can be obtained there.

CURRENTS.—The current sets westward along the entire northerly shore and about half the length of the southerly shore, where an easterly current may be expected.

From Cape Halawa to Kamalo, a distance of about 12 miles, the coast has a general southwesterly trend; thence to Laau Point, a distance of about 25 miles, it has a westerly trend. A reef between 1 and $1\frac{1}{4}$ miles wide fringes almost the entire coast; its widest point being in the bight about 13 miles eastward of Laau Point. During the day the limits of the reef can generally be told by the breakers, but at night vessels are cautioned to give this coast a good berth. Pukoo, Kamalo, and Kaunakakai are the only harbors on this coast.

Halawa Bay, at the northeasterly end of Molokai, is about $1\frac{1}{2}$ miles wide between Cape Halawa and Lamaloa Head and indents the coast about $\frac{3}{4}$ mile. There is no shelter from the trades, but an indifferent anchorage can be found in 5 fathoms about $\frac{1}{4}$ mile off the landing. The latter is located on the northerly side of the village. The shores of the bay are high, precipitous cliffs. Halawa consists of a few houses on the southwesterly side of the bay in the mouth of a deep gulch that penetrates the island in a westerly direction; a waterfall can be seen about 1 mile up the gulch. Besides the local steamer and a few small schooners there is little other commerce. There are two high detached rocks near the southerly shore of the bay.

Lamaloa Head, marking the westerly entrance of Halawa Bay, is a precipitous cliff about 840 feet high.

Cape Halawa, the northeasterly point of Molokai, is a cliff about 300 feet high.

The coast between Cape Halawa and Kaunakakai Harbor consists of a low, narrow strip of level land near the beach. The land rises gently, is much cut up with gulches, and is quite bare, with the exception that it is thickly wooded near the upper part of the gulches and mountains. There is a thick growth of algaroba trees along the beach.

Mokuhooniki is a small, yellow, bare, rocky island with perpendicular sides about 200 feet high, lying about 1 mile offshore and 2 miles southward of the northeasterly point of Molokai. **Kanaha Rock**, about 75 feet high, lies just southwestward of Mokuhooniki. There is probably good water in the passage between the rocks and Molokai, but strangers should not attempt it.

Pukoo Harbor, $7\frac{3}{4}$ miles southwestward of Cape Halawa, is a pocket, 500 yards long with a clear width of 150 yards at the entrance and somewhat wider inside, in the reef and open southeastward. The harbor is an anchorage for small craft only on account of the limited swinging room; depths of 3 to 4 fathoms can be carried well in the harbor. The harbor is smooth during the trades, although the wind sweeps across it with full force. Pukoo consists of a few houses on the lowland near the beach in front of a deep gorge which has steep sides. A white church stands on the easterly side of Pukoo Valley just eastward of the village. A steamer from Honolulu calls weekly.

Kamalo Harbor about 5 miles west-southwestward of Pukoo Harbor, is a pocket in the reef, open southward, consisting of two arms, each about $\frac{1}{2}$ mile long and 150 yards wide. The entrance is closed by a

bar with depths of 9 to 12 feet over it, outside of which an anchorage can be found, but there is no shelter from the trade winds or sea. The entrance to the harbor is marked by Kamalo Point Reef gas buoy, which lies about $\frac{3}{8}$ mile southeastward of the bar. A steamer from Honolulu calls weekly.

Kaunakakai Harbor, 9 miles westward of Kamalo Harbor, is a pocket, 600 yards long and 200 yards wide, in the reef and open southward. It is an anchorage for small craft only, on account of the limited swinging room, and the local steamers using the harbor go to the wharf. The latter extends $\frac{1}{2}$ mile off from the village of Kaunakakai to the easterly side of the harbor; the harbor is reported to be shoaling, but 20 feet can be taken to the westerly side of the end of the wharf. Kaunakakai consists of a few houses showing through the algaroba trees near the mouth of the largest gulch in the vicinity. Some cattle are shipped. A tall wireless-telegraph pole stands about 200 yards eastward of the inshore end of the wharf; the latter is also prominent.

Approaching Kaunakakai Harbor from either direction keep well outside of the reef which fringes the coast to a distance of about 1 mile until off the entrance. Vessels can anchor temporarily just outside the entrance buoy (nun, black and white perpendicular stripes), in about 15 fathoms, but there is no shelter from the trade winds and sea; or from the entrance buoy steer 35° true (NNE $\frac{1}{4}$ E mag.) on the line of Kaunakakai range lights, and leave the buoys on the sides indicated by their color. Small craft can anchor on the range, just inside the end of the wharf, in 3 to 4 fathoms.

Between Kaunakakai and Laau Point the country is bare and rocky and much cut up by small gulches. The beach is sandy, with an occasional algaroba grove here and there. There are no prominent landmarks or signs of habitation along this section of the coast.

Laau Point, the southwesterly point of Molokai, is low and is marked by a light. An extensive reef makes off shore for about $\frac{3}{8}$ mile, and vessels should give the point a berth of about 1 mile.

Penguin Bank, an extensive shelf, makes out from the western end of Molokai, in a general west-southwesterly direction for a distance of 26 miles from Laau Point. The bottom on the bank is fairly flat and consists of sand and coral, with soundings of 24 to 30 fathoms. There is a reported sounding of 7 fathoms, $17\frac{1}{2}$ miles westerly from Laau Point, but its existence has never been verified. Along its northern, western, and southern edges it drops off very abruptly into over 100 fathoms. In the vicinity of Laau Point there is a continuous westerly current flowing along the south shore of Molokai and turning sharply to the north as it rounds the point. There is a strong tide rip west and north of the point forming breakers when the wind is northerly. There is a strong northeast set over the entire bank, which joins the northerly current along the west coast of Molokai. This current is not felt in the deep water west of Penguin Bank, but is apparent at the edge of the bank, when passing inside of the 100-fathom curve. There is no apparent connection between this current and the tides, and the trade winds appear to have little effect upon it, although it appears to be stronger or weaker according as there is a barometric depression north or south of the islands.

Between Laau Point and Ilio Point, a distance of about 8 miles, the west coast of Molokai is bare, low, and rolling, cut up by a few

small gulches, and rises gently from the beach, the latter being marked by low bluffs and short stretches of sand beaches.

Ilio Point, the northwesterly point of Molokai, is a low peninsula about 1 mile long and $\frac{3}{4}$ mile wide and rounded at its outer end.

From Ilio Point to Cape Halawa, a distance of about 32 miles, the north coast of Molokai has a general easterly trend. It is not surveyed, but is generally bold.

There are no harbors or anchorages on this coast affording shelter in all winds. There are a few ports where the local steamer calls, but with this exception there is practically no traffic along this coast, and no reason for deep-draft vessels to stand close to shore.

Between Ilio Point and Makanalua Peninsula the country has very little vegetation. Beginning at Ilio Point, the bluff gradually becomes lower, and within 5 miles entirely disappears. At this point a low, precipitous cliff runs inland at right angles to the beach and forms the westerly boundary to the low plain that extends across the island. The seaward end of this cliff looks like a large white sand bank, and is the most conspicuous landmark in the vicinity. From this cliff eastward the bluffs along the coast gradually increase in height until they become precipitous cliffs, in some places between 2,000 and 3,000 feet high, and continue to the northeast end of the island.

Makanalua Peninsula, 16 miles eastward of Ilio Point, is marked by Molokai light. The peninsula is low and extends out about 2 miles northward from the face of a high, precipitous cliff. The leper settlement of **Kalaupapa** occupies the peninsula. There is deep water close to the peninsula, except on the westerly side, where a reef about $\frac{3}{4}$ mile long extends about $\frac{1}{4}$ mile offshore, just northward of the landing at Kalaupapa. An indifferent anchorage can be found in 12 fathoms just off the landing, with the church bearing 100° true (E mag.), but a permit must be obtained, unless on Government business.

Between Makanalua Peninsula and Cape Halawa the country presents a very irregular and jagged appearance, and is more or less covered with vegetation. The precipitous cliffs along the coast are much cut up with deep gulches, bights, and headlands, and except for a few piles of débris at the foot of the cliffs and a few level spots in the mouths of the gulches, no landing can be made.

Between Makanalua Peninsula and Umelehi Point, 6 miles eastward of Molokai light, there are several detached rocks, some of which lie about $\frac{3}{4}$ mile offshore. There may be submerged rocks in this locality, and strangers are cautioned to keep well offshore.

Pelekunu Landing is on the westerly side of a deep gulch about $5\frac{3}{4}$ miles eastward of Molokai light. There is a small village here. The local steamer calls, but outside of this there is no trade.

Wailau Landing is on the westerly side of Lepau Point, about 8 miles eastward of Molokai light. There are a few houses here, and the local steamer calls.

About 5 miles westward of Cape Halawa is a deep gulch, in which can be seen a waterfall that starts from an elevation of about 2,000 feet, and in one place has a perpendicular fall of about 500 feet.

Kaiwi Channel lies between Molokai and Oahu, and is about 22 miles wide and clear of obstructions. The trade winds which follow the northerly and southerly shores of Molokai draw across the channel

toward Makapuu Head. Little dependence can be placed on the currents in this channel, but in general they are apt to follow the trade winds, and when they cease the current is apt to set eastward.

OAHU,

the third in size of the islands, lies 22 miles westward of Molokai. It is about 40 miles long between Makapuu Head and Kaena Point and about 26 miles wide between Kahuku Point and Barbers Point. It includes two important mountain systems, and in general presents a more rough and jagged skyline than any of the other islands.

Koolau Range parallels the northeasterly coast for nearly its entire distance. The southeasterly part, between Makapuu Head and a point abreast of Heeia or Kaneohe Bay, is marked on its seaward side by a sheer, rocky cliff, or pali, nearly 2,000 feet high in places. Northwestward of this point the cliffs give way to steep, rugged slopes. From offshore the northwesterly half of the range presents a long ridge sloping gradually downward and ending in low bluffs near Kahuku Point.

The crest of the ridge and about half the seaward slope is wooded, below which it is grass-covered. The entire range presents a very jagged appearance and is cut up on its inshore side by deep gorges and valleys. The greatest elevation found on this range is **Kona-huanui Peak**, which is 3,105 feet high. This peak is back of Honolulu, on the east side of Nuuanu Valley, and overlooks the famous Nuuanu pali at the head of the valley. On the easterly side of the range the land is low and rolling, cut up by a few sharp hills, and is under cultivation.

Waianae Mountains parallel the southwesterly coast for nearly the entire distance between Kaena Point and Barbers Point. Several spurs extend from the range toward the shore, forming short valleys. The range is much broken, and there are a number of high peaks. **Mount Kaala**, over 4,000 feet high, has the greatest elevation.

Between these two important ranges is a plain which extends from Pearl Harbor to Waialua. This plain is under cultivation, except in the middle, where it is high and rolling and somewhat cut up.

RIVERS.—There are numerous streams emptying into the sea, none of which are navigable except for small boats.

POPULATION.—By the census of 1910, Oahu had 81,993 inhabitants.

WINDS.—The trade winds generally divide in the vicinity of Makapuu Head, one part following the northeasterly coast and the other part following the southerly coast past Diamond Head. Between Diamond Head and Honolulu the wind comes offshore during the trades.

RAINFALL.—The rainfall in Oahu varies greatly in different localities. The greatest amount is found on the northeasterly side of the Koolau Range back of Kaneohe Bay.

ANCHORAGES are numerous, except on the northeasterly and northwesterly sides, the first requirement under ordinary conditions being shelter from the trade winds.

SUPPLIES.—Provisions, water, ice, lumber, coal, fuel oil, and ship chandlers' stores can be obtained at Honolulu.

REPAIRS.—There are machine shops at Honolulu where extensive repairs can be made. There is a floating dry dock, with a dead-weight capacity of 4,500 tons, and divers may be obtained.

COMMUNICATION with the United States, British Columbia, Australia, and the Orient may be had by several regular lines of steamers. There is frequent communication by coasting steamers around the islands.

RAILROADS.—There is a railroad that runs westward from Honolulu along the southwesterly and northwesterly coast as far as Kahana, on the northeasterly coast. A branch of this railroad runs to Waihai-awa, in the interior of the island.

HIGHWAYS.—There are good highways in many parts of the island, and transportation can be obtained at most of the towns.

TELEPHONE.—There is communication by telephone to all parts of Oahu, and by wireless telegraph to the other islands, United States and the Orient. There is cable communication with San Francisco and also with Manila via Midway and Guam.

QUARANTINE.—National quarantine laws are enforced by officers of the United States Public Health Service.

MARINE HOSPITAL.—An assistant surgeon of the United States Public Health Service is stationed at Honolulu for the treatment of seamen.

CURRENTS.—The currents around Oahu are variable in strength and direction, but the general movement of the water along the coast is westward or northwestward, the direction being modified by the trend of the coast.

From Makapuu Head to Barbers Point, a distance of about 28 miles, the coast has a general westerly trend. It is fringed with coral reefs, varying from $\frac{1}{2}$ to 1 mile in width, for nearly the entire distance between Koko Head and Barbers Point.

Honolulu and Pearl Harbors are the only ones on the coast affording protection in all winds.

Makapuu Head, the easternmost point of Oahu is a bold, barren, rocky headland, nearly 700 feet high, on which is located Makapuu Point lighthouse. The seaward side of this headland is a high, dark, sheer precipice, while the inshore side slopes rapidly to the valley which separates it from the mountain range. Makapuu Head is prominent, and is generally the landfall for vessels bound from San Francisco to Honolulu. There is deep water close to the easterly end of the head, but between it and a position about abreast of Koko Crater a ledge makes offshore. The sea always breaks close to shore in this vicinity, and the 10-fathom curve is about $\frac{3}{4}$ mile from shore. Vessels should give this section of the coast a berth of about 1 mile, taking care to keep in not less than 20 fathoms.

Between Makapuu Head and Koko Crater the coast is low and made up of sand, rock, and shingle.

Koko Crater, about 2 miles southwestward of Makapuu Head, is a sharp, brown cone, about 1,200 feet high, and is a prominent landmark for vessels approaching from eastward.

Between Koko Crater and Koko Head the coast is rocky and precipitous and somewhat irregular.

Hanauma Bay, just eastward of Koko Head, is about $\frac{1}{4}$ mile wide and indents the coast about $\frac{3}{8}$ mile. It affords good shelter for small

craft, but during east-northeast or easterly winds it is very choppy off the entrance.

Koko Head, about 2 miles southwestward of Koko Crater, is a bold promontory 644 feet high. It has a flat top, with its seaward side precipitous, and slopes off rapidly inshore. This headland is partly wooded on the lower slopes on the westerly side, but in general it presents a brown and barren appearance. There is deep water close to the point.

Maunalua Bay is an open bight on the westerly side of Koko Head. It is free of obstructions and affords protection in northerly and northeasterly weather. During east-northeast trades the swell sets in, but a fair anchorage can be obtained near the head of the bay. A coral reef fringes the shore, but there is a narrow opening near the head of the bay, through which a landing can generally be made by boats. The shore of the bay is low and wooded, and a few houses and a windmill or two can be seen. The depths in the bay are regular, and vessels can anchor anywhere in smooth weather.

Kupikipikio Point, about $4\frac{1}{2}$ miles westward of Koko Head, is a flat-topped, dark hill, with a rocky shore. A searchlight on the summit is prominent.

Diamond Head, about 6 miles westward of Koko Head, is an extinct crater, 761 feet high, on the southerly side of which is located Diamond Head lighthouse. The slopes and the top of the crater are bare and brown, but at its base it is thickly wooded. The slopes are steep, and on the seaward side there is a narrow bench about 100 feet above the water, which shows a broken bluff line to seaward.

Between Diamond Head and Honolulu the coast is low and thickly wooded. Numerous houses can be seen along the beach, the most prominent of which is a large building close to Diamond Head and the Moana Hotel.

Honolulu Harbor is described under a separate heading following the description of the island.

Between Honolulu and Barbers Point the coast is a low, white, sandy beach covered with trees. Just eastward of Honolulu there is an extensive inlet, much of which is bare at low water. This entire stretch of coast is fringed by a coral reef over which the sea generally breaks. The only openings in the reef are Honolulu entrance, Kalihi entrance, and Puuloa (Pearl Harbor) entrance, but it is possible that landings might be made at other places in smooth weather.

The country back of the coast is low and covered with sugar cane; several large mills can be seen, the most prominent of which is the one at Ewa. This mill is large and around it are grouped several small, white buildings.

Kalihi Entrance, about $1\frac{1}{2}$ miles westward of Honolulu, is a narrow channel through the reef, used only by boats and launches.

Pearl Harbor, 5 miles westward of Honolulu, is a large, irregular-shaped inlet, much cut up by points and islands, and containing three large basins. It is a secure harbor for vessels of any draft. The harbor is reserved by the United States as a naval station, and permission must be secured by foreign vessels before entering.

The channels connecting the lochs are narrow and lined on both sides by reefs with sheer sides, which extend but a short distance offshore and are easily distinguished by the color, as they have but

a few feet of water over them. The entrance has been straightened and improved by cutting off the reefs at the angles and dredging through the bar a channel 600 feet wide and 35 feet deep. The channel is marked by beacons and buoys.

ANCHORAGE with good holding ground can be found in any of the lochs, for which the chart is the guide. Good anchorage can be found outside the bar in 10 fathoms, the best place for large vessels being westward of the entrance.

Puuloa village is located on the westerly side of the entrance to the river. Near the village are large salt works.

Watertown is a small village located near the entrance to the river, opposite Hammer Point.

About 1 mile above Puuloa village the channel branches at Waipio Point, the southerly end of Waipio Peninsula. The west branch leads to West Loch, the east branch to East, Middle, and Southeast Lochs, the latter being divided into two channels by Mokumeume (Ford Island).

Pearl City and **Waipio Peninsulas** are low, and include several large fish ponds. There is a settlement on the southerly end of Pearl City Peninsula which is used as a summer resort for the people of Honolulu.

Pearl City is located at the northerly end of the peninsula; it has a water system and water can be obtained here.

RAILROAD.—The Oahu Railroad runs along the shore of Pearl Harbor from Southeast Loch to the southwesterly end of West Loch, with a branch line down Pearl City Peninsula.

WINDS.—The trades are freshest during July and August and are felt most in East Loch, but during the winter season they are interrupted by the kona winds, which at times are quite strong.

Barbers Point is a low, flat coral plain covered with algaroba trees, and is marked by Barbers Point lighthouse. The coast curves gradually and shows a white sandy beach with here and there dark rocks. The land is level back to the foothills of the Waianae Mountains, which are about 3 miles from shore. The slopes of the hills are steep and partly covered with vegetation, the bare, red soil showing in places and giving them a noticeable reddish appearance.

From Barbers Point to Kaena Point, a distance of about 19½ miles, the southwest coast of Oahu has a general northwesterly trend. It is in most part bold, but there are a few outlying dargars, which will be avoided by giving the coast a berth of at least 1½ miles. The coast consists of alternating ledges of rock and stretches of white sand beaches. The land near the coast is in most part high. Spurs extend to the coast from the Waianae Mountains, forming valleys. The valleys are heavily wooded, but the mountains are rocky and bare. There are no harbors or anchorages affording shelter in all winds. A shoal between ½ and ¾ mile wide fringes the coast from Barbers Point to Kahe Point.

Kahe Point, 3½ miles northwestward of Barbers Point, is the seaward end of a mountain spur.

Puuhuhu Ridge, 3½ miles northwestward of Kahe Point, is a narrow, rocky, barren ridge, 1½ miles long, located at the southerly one of the two important projecting points of this coast, and is the most conspicuous landmark in this vicinity. The westerly end of the hill is close to the shore, and has an elevation of 856 feet, and is precipitous on its seaward side.

From a point abreast of Punhulu Ridge, a shoal $\frac{1}{2}$ mile wide in places fringes the coast northwestward as far as Kepuhi Point.

Maili Hill, about 2 miles northward of Hulu Hill, is a narrow, rocky ridge, 729 feet high, standing near the shore and approximately at right angles with it.

Kaneilio Point is a small, low point on the southerly side of Pokai Bay.

Pokai Bay, about 1 mile northwestward of Maili Hill, is a small indentation in the coast, on the shore of which the town of **Waianae** is located. Most of the town is hidden by the trees, but a mill stack is prominent from offshore. **Waianae** is on the railroad and there is practically no shipping by water. Landing can generally be made except during southerly winds. In entering Pokai Bay, vessels should head for the mill stack at **Waianae** on an 80° true (ENE $\frac{1}{8}$ E mag.) course, and anchor about $\frac{1}{2}$ mile offshore in 8 to 10 fathoms.

Waianae plantation occupies the deep valley which lies between **Hulu Hill** and **Lahilahi Point**. This valley extends back into the island about 4 miles, and is the largest one on this side of the **Waianae Mountains**. The broken ridge which makes down to **Maili Hill** divides the valley in two.

Lahilahi Point, $1\frac{1}{2}$ miles northwestward of **Waianae**, is a detached, steep ridge of dark rock about 230 feet high, which forms a narrow point projecting about $\frac{1}{4}$ mile.

Kepuhi Point, about $1\frac{1}{8}$ miles northwestward of **Lahilahi Point**, marks the seaward end of a bold, rocky, mountain spur, which comes to within a few hundred yards of shore. At the base of the bluff there is a low, narrow strip of thickly wooded land.

Two miles northward of **Kepuhi Point** is a group of conspicuous sand dunes which are known as the "barking sands."

Makua village, 3 miles northward of **Kepuhi Point**, is at the head of the first bight below **Kaena Point**. The red church spire, beside which is a white house, shows well from seaward. Two or three other houses, a windmill or two, and two railroad trestles can also be seen. Back of the village is a small crater-shaped valley. There is a sand beach at the head of the bay, where boats can land when there is little swell. Vessels can anchor within $\frac{1}{4}$ mile of shore in 4 to 6 fathoms.

Between **Makua village** and **Kaena Point** the coast is rocky, except for one short sand beach, and the mountains rise steeply from the beach.

Kaena Point, the westernmost point of **Oahu**, is a low, rocky point extending out a few hundred yards from the foot of **Kuaokala Ridge**. There are two or three noticeable sand dunes on the point. Just off the end of the point are several low, jagged rocks, over which the sea washes, and the sea breaks offshore to a distance of about $\frac{1}{4}$ mile. **Kuaokala Ridge** is high and its seaward end breaks off rather abruptly.

From **Kaena Point** to **Kahuku Point**, a distance of about $18\frac{1}{2}$ miles, the northwest coast of **Oahu** has a general easterly trend as far as **Kaiaka Bay**, and thence northeasterly to **Kahuku Point**. It is fringed with a reef for its entire distance, but all dangers will be avoided by giving the coast a berth of at least 1 mile. The coast consists of alternating ledges of rock and stretches of white sand beaches. There are no harbors or anchorages affording shelter in all winds. The land rises steeply to the summit of the ridge that extends toward **Kaena Point**.

About $6\frac{1}{2}$ miles eastward of Kaena Point and $\frac{1}{2}$ mile off the village of Mokuleia there is a rock awash. The breaker or the rock itself is always visible.

Kaiaka Bay, 9 miles eastward of Kaena Point, is a small indentation in the coast.

Waialua Bay, 10 miles eastward of Kaena Point, is a small indentation at the bend near the middle of the northwest coast of Oahu. The bay is of no commercial importance. Its shores consist of low, black rock, with sand patches in the bights.

PROMINENT OBJECTS in the vicinity of Waialua are the church spire, the two flagstaffs on the Haleiwa Hotel, the roof only of which shows above the trees, and a large black chimney, with a mill beside it. There is a small islet on the northerly side of the bay, but it is not easily identified from offshore.

About 1 mile northeastward of Waialua Bay and $\frac{3}{8}$ mile inland is a pumping station with two large smokestacks. Back of the pumping station, on the brow of the hill, is a grove of trees and a plantation settlement.

Between Waialua and Kahuku Point there is a narrow strip of low land along the coast, back of which is a table-land covered with vegetation, with steep grassy slopes facing the sea. These slopes are cut up in places by deep gorges.

Waimea Bay, $3\frac{1}{2}$ miles northeastward of Waialua Bay, is a small indentation in the coast at the mouth of a deep gorge which divides into two branches some distance up. The bay affords little shelter, and a landing can be made only in very smooth weather. It is of no commercial importance. When close in, a railroad bridge can be seen across the stream that flows down the gorge. There are several scattered buildings on the northerly side of the bay. The beach at the head of the bay is sandy, but on both sides of the entrance it consists of low, rocky ledges.

Off the southerly entrance point are two ragged masses of black rock, with deep water close to on the offshore side. Near the northerly entrance point are some submerged rocks, which are generally marked by breakers. Vessels can stand in for the middle of the bay and anchor about $\frac{1}{4}$ mile offshore in 9 to 10 fathoms, sandy bottom, with the mouth of the river bearing 101° true (E mag.).

About $3\frac{1}{2}$ miles northeastward of Waimea Bay and $\frac{1}{4}$ mile inland is the Waialeale industrial school, a group of prominent buildings.

About $1\frac{1}{4}$ miles northeastward of the Waialeale industrial school and $\frac{1}{2}$ mile inland is a prominent smokestack standing at the end of a high flume.

Kahuku Point, the northernmost point of Oahu, is low, covered with sand dunes, and has a few scattered palms. The coast rounds gradually at this point, and there are a number of small black rocks close inshore. The land rises gently from the bluffs at the point to the mountains. Off this point the 10-fathom curve draws in to about $\frac{3}{8}$ mile from shore, and in the daytime the breakers afford sufficient warning to guide clear of all dangers. At night, however, great care must be used, as it is difficult to locate the point, on account of the low land and the absence of any aids to navigation.

From Kahuku Point to Makapuu Head, a distance of about 31 miles, the northeast coast of Oahu has a general southeasterly trend. It is fringed with coral reefs for nearly its entire distance.

Between Kahuku Point and Kaneohe Bay the beach is for the most part low and sandy, with black rocks showing in places. There is a narrow strip of low, cultivated land between the beach and the foot of the mountains, which narrows as Kaneohe Bay is approached. A wagon road and railroad parallel the coast, and numerous villages can be seen from offshore.

PROMINENT OBJECTS along the coast are: A tall black stack about 1 mile southward of the extreme northerly end of the island; a wireless-telegraph pole near the beach, about 2 miles northwestward of Laie Bay; a large black stack about $\frac{3}{8}$ mile southwestward of the wireless pole; the Mormon Church at Laie Bay; two church spires near the beach, about $\frac{1}{8}$ mile apart and about 2 miles northwestward of Kahana Bay; and two schoolhouses, with flagpoles, standing close together near the beach, about $1\frac{1}{4}$ miles southeastward of Kahana Bay.

Laie Bay, 5 miles southeastward of Kahuku Point and 1 mile northwestward of Laie Point, is a narrow opening in the reef, with depths of 3 to 7 fathoms, where small craft with local knowledge can find shelter and make a landing. There are three small, low islets in this vicinity, the middle one being the largest. The entrance of the bay is near the south side of the middle islet on a 214° true (SSW $\frac{1}{8}$ W mag.) course for the Mormon Church (large and prominent, with cupola). Strangers should not attempt to enter without a pilot.

Laie Point is low, and has a rocky beach. Off its end are two small, flat, rocky islets.

Kahana Bay, $6\frac{1}{2}$ miles southeastward of Laie Bay, is a long, narrow opening in the reef lying at the mouth of a valley, where small craft with local knowledge can find shelter. Kahana village, partly hidden by the trees, is at the head of the bay. The breakers on both sides of the bay are the only guide for entering.

Kaneohe Bay, 4 miles southeastward of Kahana Bay and just northwestward of Mokapu Peninsula, is about 5 miles wide between Kualoa Point and Pyramid Rock and indents the coast about 2 miles. It is full of reefs and shoals with depths of 7 to 8 fathoms between. There is an entrance near the northwesterly end of the bay and one near the southeasterly end, and with local knowledge it is possible to take 10 feet through the former and 8 feet through the latter. In heavy trades the sea breaks across both entrances. Strangers should not attempt to enter without a pilot.

Pyramid Rock, the northwesterly point of Mokapu Peninsula, is black and has a sharp summit.

Mokapu Peninsula, about 19 miles southeastward of Kahuku Point and 10 miles northwestward of Makapuu Head, is a prominent landmark with a greatest elevation of 695 feet; Ulupau Head, at the northeasterly end of the peninsula, is a rocky headland, part of the rim of an old crater. Mokomann Islands, lying $\frac{3}{4}$ mile northward of the head, are two small islands, about 200 feet high, with vertical sides. The passage southward of the islands has a depth of about 5 fathoms in mid-channel, but it should not be used by strangers.

Between Mokapu Peninsula and Makapuu Head, the beach is for the most part low and sandy with black rocks showing in places. There is a narrow strip of cultivated land between the beach and the

foot of the sheer, rocky cliffs, or pali. These sheer cliffs are a characteristic of the mountains from a point abreast of Kaneohe Bay to Makapuu Head. The mountain range gradually draws nearer to the coast as Makapuu Head is approached.

Kailua Bay, southeastward of Ulupau Head, is an open bight affording no shelter from the trades. The beach at the head of the bay is sandy.

Between Kailua and Waimanalo Bays may be seen a group of grass-covered hills near the beach.

Mokolea Rock, lying about 1 mile offshore in the northerly part of Kailua Bay, is a small black rock, about 20 feet high, with 5 to 8 fathoms around it.

Mokulua Islands, the northerly one 206 feet high and the southerly one 182 feet high, are steep, rocky islets with grass-covered slopes, lying about $\frac{3}{4}$ mile offshore and midway between Alala and Wailea Points.

Waimanalo Bay, lying between Wailea Point and Makapuu Head, affords shelter in all weather behind the barrier reef which parallels the coast in this vicinity. The entrance is in the northwesterly part of the bay, with a least depth of 12 feet over the bar and 10 feet inside. During strong trades the entrance is closed by breakers. There is a small wharf in the southerly part of the bay. The small craft calling here lie off its end and lighter their cargo. There is a shallow boat passage along the beach between Waimanalo Bay and Kailua Bay.

Manana Island, 359 feet high, lies 1 mile north-northwestward of Makapuu Point lighthouse. It is part of an old crater and consists of a lighter shade of rock than any in the vicinity. Its sides are bluff, except on the westerly side, where there is a short sloping point. There is deep water close to on the northeasterly side of the island. There is a depth of about 4 fathoms between Manana Island and the mainland, but it should not be attempted by strangers.

Kaohikaipu Island is a flat, black mass of rock, about 70 feet high, lying about midway between Manana Island and Makapuu Head. A double rock about 10 feet high lies 200 yards northeastward of the islands. In a heavy swell the sea breaks about 100 yards outside of the rock. A small black rock, just showing above the water, lies about 170 yards southwestward of the island. There is a depth of about 5 fathoms between Manana and Kaohikaipu Islands, but owing to the reefs which make off from both islands, strangers should not attempt it.

There is good water in the bight between Kaohikaipu Island and Makapuu Head, but vessels should not attempt to pass through between the island and the mainland.

Kaieiewaho (Kauai) Channel, between Oahu and Kauai, is about 64 miles wide and clear of obstructions. During trade winds the current generally sets westward across the channel and when Kauai is reached it divides, part following around the northerly side of the island and another part around the southerly side. During the first calms after strong trades the current often sets eastward. Strong southerly or southwesterly winds cause the current to set in the opposite direction to that produced by the trades.

HONOLULU HARBOR

is the most important commercial port in the Hawaiian Islands, and, with the exception of Pearl Harbor, is the only harbor affording protection in all weather. It lies 15 miles westward of Makapuu Head and 13 miles eastward of Barbers Point. The entrance through a coral reef is a channel $\frac{5}{8}$ mile long and 400 feet wide, and the harbor is $\frac{1}{2}$ mile long and 1,000 to 1,200 feet wide, and both have been dredged to a depth of 35 feet; in 1918 the least depth in the channel was 35 feet. The channel is well marked by lights and buoys, and the harbor is easy of access for steamers both day and night. There are depths of between 20 and 33 feet alongside the principal wharves.

Honolulu is the capital of the islands. It is a city with all modern improvements, and in 1910 had 52,183 inhabitants. The city is located on the low plain that lies at the foot of the Koolau Range, about halfway between Makapuu Head and Barbers Point. There is a large foreign and coastwise trade here.

PROMINENT OBJECTS.—Honolulu Harbor lighthouse and the Quarantine station with a white flagpole are on the westerly side of the harbor. The crematory chimney is on the easterly side of the harbor. Punchbowl is a flat-topped, conical hill, about 500 feet high, lying immediately back of the city. Mount Tantalus, about $2\frac{1}{2}$ miles northeastward of Punchbowl, is a rounded peak about 2,000 feet high, and is heavily wooded at its summit. Mount Konahuanui, about 2 miles northeastward of Mount Tantalus, is 3,105 feet high and is the summit of the Koolau Range. It consists of double peaks, which when seen from southward of Honolulu appear to be about the same height. Mount Lanihuli, about $1\frac{1}{2}$ miles west-northwestward of Mount Konahuanui, is dome-shaped, with a flat summit, and is 2,775 feet high. Mount Kaala, about 4 miles north-northeastward of Waianae, is a flat-topped peak, the highest of the Waianae Mountains, and is 4,030 feet high.

PILOTAGE is not compulsory, but vessels are required to pay half pilotage when a pilot is not taken, unless they have a coasting license. Pilots come out in small boats and meet vessels just outside the entrance.

TOWBOATS can be had. Regular rates have been adopted, but for towing vessels from outside the pilot limits an agreement is made between the vessel and the towboat.

ANCHORAGE.—The usual anchorage is on the westerly side of the harbor, north of the Quarantine wharf. Vessels generally let go both anchors and moor with stern lines to moorings planted on the edge of the reef. Vessels sometimes anchor outside of the harbor on either side of the entrance in 8 to 10 fathoms, sandy or coral bottom. The shoaling is more gradual and the depths more moderate on the west side of the entrance. The water shoals rapidly toward the reef, and vessels should approach the desired depths with caution. This anchorage is exposed to all southerly winds.

HARBOR REGULATIONS are enforced by the harbor master.

QUARANTINE.—Vessels are boarded outside by surgeons of the Public Health Service at Honolulu, from whom full information can be gotten concerning quarantine and sanitary regulations.

MARINE HOSPITAL.—There is a commissioned officer of the Public Health Service at Honolulu, to whom application can be made for relief.

SUPPLIES.—Coal and fuel oil can be obtained. Water can be obtained alongside the wharves or from water boats. Provisions and ship chandlers' stores are to be had in the city.

REPAIRS.—There is a floating dry-dock with a dead-weight capacity of 4,500 tons. There are machine shops and shipyards where extensive repairs can be made. Divers can be obtained.

TIME SERVICE.—Vessels can obtain chronometer comparisons and geographical information relative to the islands at the Government survey office.

SAILING DIRECTIONS, HONOLULU HARBOR.

The harbor is easy of access for steamers, both day and night. The trades generally blow offshore, and sailing vessels have to tow in. The following directions lead in a least depth of about 35 feet:

FROM EASTWARD.—Passing $1\frac{1}{2}$ miles or more south-southeastward and 1 mile or more south-southwestward of Diamond Head light-house, steer for Mount Kaala, the highest peak of the Waianae Mountains, on a $309^{\circ} 30'$ true (NW by W $\frac{3}{8}$ W mag.) course for about 4 miles until off the entrance of the harbor.

Then steer $29\frac{1}{2}^{\circ}$ true (N by E $\frac{5}{8}$ E mag.), with Honolulu Channel Range Lights ahead, and pass between the buoys and lights that mark the sides of the channel. When inside of Honolulu Harbor lighthouse, haul northward, passing along the wharves.

FROM WESTWARD.—Passing $1\frac{1}{2}$ miles or more southward of Barbers Point, vessels can at night steer for Diamond Head light-house on any bearing northward of 93° true (E $\frac{5}{8}$ N mag.), or in the daytime steer on any bearing northward of $87^{\circ} 30'$ true (ENE $\frac{7}{8}$ E mag.) for Koko Crater. The distance from Barbers Point to the entrance is 13 miles, and either course will lead clear until off the entrance of the harbor. Then follow the directions in the preceding paragraph.

KAUAI,

the fourth in size of the islands, lies 64 miles west-northwestward of Oahu. It is nearly circular in shape, about 23 miles in diameter, and slopes from the central mountain mass of Waialeale, which has a greatest elevation of about 5,200 feet. On the westerly and northerly sides the mountains slope in steep and jagged ridges, and on the easterly and southerly sides in gentle slopes, which are much cut up by gulches.

There are few outlying dangers, and by giving the coast a berth of 2 miles all danger will be avoided.

RIVERS.—There are numerous streams emptying into the sea, none of which are navigable except for small boats.

POPULATION.—By the census of 1910, Kauai had a population of 23,744 inhabitants.

WINDS.—The trade winds divide on the easterly side of Kauai, part following the northerly and part the southerly coasts, uniting again on the westerly side of the island.

RAINFALL.—The weather side of the island is noted for its frequent heavy rainfalls, while very little reaches the southerly side.

ANCHORAGES are numerous, but none of them afford shelter in all weather for large vessels.

SUPPLIES.—No supplies of any kind can be obtained, except some provisions in case of necessity.

COMMUNICATION with Honolulu is frequent. Vessels of the American-Hawaiian Steamship Co. and the Matson Navigation Co. call to load sugar.

HIGHWAYS.—There are good highways in many parts of the island, and transportation can be obtained at most of the towns.

TELEPHONE.—There is telephone communication to all parts of the island, and by wireless telegraph to Honolulu.

CURRENTS.—The currents are said by many of the best interisland navigators to be very uncertain as to direction, but they generally follow the winds, though frequently setting in the opposite direction during the first calms after strong trades.

Nawiliwili Bay, at the southeast end of Kauai, is about $\frac{3}{4}$ mile wide between Ninini Point and Carter Point and indents the coast about $\frac{7}{8}$ mile. The shore is rocky bluffs, except at the mouth of Huleia River and in the northwesterly part near the landing at Nawiliwili village. The inner part of the bay is obstructed by reefs, but with local knowledge small steamers enter to discharge or load. The anchorage used by these steamers is just inside Kukii Point, and is marked by a mooring buoy, to which vessels make their stern lines fast. In the absence of local knowledge, the inner harbor should not be attempted by anything but small craft. An anchorage for deeper-draft vessels can be found anywhere in the bight between Ninini and Kukii Points.

A reef over which the sea generally breaks, and with depths of less than 1 fathom in places, extends about $\frac{3}{8}$ mile northward from Carter Point. Vessels can avoid this reef when entering the inner bay by keeping close to Kukii Point.

Ninini Point is low and marked at its east end by Nawiliwili Harbor light. There is a tall wireless-telegraph pole northward of the light.

Kukii Point, $\frac{3}{4}$ mile westward of Ninini Point, is a high bluff with deep water close-to, and is marked by a light.

Huleia River, at the southwesterly end of the bay, is navigable several miles for boats.

Carter Point is rocky and rises rapidly to a peak 786 feet high. The mountain spur which makes inland from this point rises to **Haupu Peak**, 2,280 feet high, which is the most prominent landmark in southeastern Kauai.

Kawai Point, $\frac{1}{2}$ mile southward of Carter Point, is a bold, rocky headland 625 feet high.

Kawelikoa Point, 3 miles southwestward of Kawai Point, is a dark, rocky, headland, about 700 feet high, at the end of a ridge making northward to Haupu Peak.

From a point about 2 miles northeastward of Makahuena Point to Waimea Bay the coast is made up of low bluffs, the country is all under cultivation, and in places the cane fields extend well up the mountains.

Makahuena Point, the south end of Kauai, is low, flat, and sandy and is marked by a light. The land in this vicinity is low and rolling. A reef is said to extend about $\frac{1}{2}$ mile off the point.

Koloa Bay, $1\frac{1}{2}$ miles westward of Makahuena Point, is marked by a warehouse, which stands on the bluff just above the landing. It is a small indentation affording fair protection in trade weather. At

night a fixed-red light, maintained by private parties, is shown from a pole in front of the warehouse. A narrow reef fringes the shore, just outside of which the small local steamers anchor. Anchorage, with good holding, can be found in 10 fathoms about 300 yards off the landing.

Between Koloa and Hanapepe Bays there are several small bays in which small craft can find shelter during trade weather.

Hinalua (Makakahai) Point, about $3\frac{1}{4}$ miles westward of Koloa Bay, may be recognized by three red, bare, conical hills close to the beach.

Lanipua Rock, with 3 feet over it, and marked by a nun-buoy, lies $4\frac{1}{4}$ miles westward of Makahuena Point and $\frac{3}{8}$ mile southeastward of Hinalua Point. Vessels should not attempt to pass northward of the buoy.

Hanapepe Bay, 8 miles westward of Makahuena Point, is about $\frac{1}{2}$ mile wide and indents the coast $\frac{3}{8}$ mile. It affords shelter during the trades, with good holding ground. The shores of the bay are low, rocky bluffs, except at its head, where it is sandy. **Eleele Landing**, locally known as Port Allen, is on the easterly side of the bay just inside the breakwater, which is built out about 100 yards from the easterly point at the entrance. At the inshore end of the breakwater is a warehouse, two large oil tanks, and a tall flagpole. A fixed red light, maintained by private parties, is shown from a mast surmounting a tripod near the inshore end of the breakwater. There are several mooring buoys southwestward of the breakwater. The local pilot will moor vessels. Small vessels can anchor 150 to 300 yards from the end of the breakwater, bearing 112° true (E by S mag.), in a depth of about 22 feet.

Hanapepe River enters the northeasterly end of the bay through a deep gulch. Boats can enter at high water, taking care to avoid the rocks at the entrance.

Ukula Point, forming the westerly side of Hanapepe Bay, is low and flat, and is marked at its easterly end by Hanapepe light, with red sector covering Lanipua Rock.

Makaweli mill is about halfway between Ukula Point and Makaweli Landing and about $\frac{3}{8}$ mile inland. It is prominent and at night is lighted by electricity. A ledge is reported to extend $\frac{3}{4}$ mile offshore between Makaweli mill and Makaweli Landing.

Makaweli Landing, about $4\frac{1}{2}$ miles northwestward of Hanapepe Bay, is a wharf built in a small bight. At the inshore end of the wharf are two white warehouses, southward of which are a few houses. When standing in for an anchorage off the landing bring the warehouses on the bearing 56° true (NE mag.). On this bearing 15 feet can be carried to within 300 yards of the wharf. The current generally sets northward and westward in this vicinity.

Makaweli Reef extends offshore about 1 mile between the point $\frac{5}{8}$ mile westward of Makaweli Landing and the easterly point at the entrance of Waimea Bay. It is marked off its end by a buoy (nun, red), and vessels should not attempt to pass inside it.

Waimea Bay, $1\frac{1}{4}$ miles northwestward of Makaweli Landing, is an open bight affording good anchorage in 3 to 9 fathoms in all but kona weather. The beach is sandy, back of which there is a narrow strip of lowland. The village is built in a coconut grove. On the slope behind the village is a prominent brownstone church. A shoal

about $\frac{1}{4}$ mile wide and with depths of 6 to 14 feet fringes the shores of the bay. **Waimea River** empties into the bay on the easterly side of the town. It comes down from the mountains through the deepest and most prominent gorge on this part of the island. When standing in for an anchorage off the landing bring the brownstone church back of the town on the bearing 16° true (N $\frac{1}{2}$ E mag.), with the wharf open just eastward of it, and anchor in 9 fathoms. Small vessels can anchor in 3 fathoms with the end of the wharf bearing 356° true (N by W $\frac{1}{4}$ W mag.), distance about $\frac{1}{4}$ mile. Provisions in limited quantities and fresh water can be obtained.

A low, flat plain, about 2 miles wide, extends westward from **Waimea Bay** around the western end of the island to a point about 4 miles southward of **Alapui Point**. Along the seaward edge of this plain may be seen algaroba trees, behind which are several high sand dunes.

Kokole Point, 5 miles west-northwestward of **Waimea Bay**, is low and rounded and is marked by a light.

The coast between **Alapui** and **Kailu** Points consists of a series of precipitous cliffs known as **Napali**. These cliffs are 2,000 feet high in places, are much cut up, and numerous streams can be seen forming small waterfalls. The southerly half of this section of the coast is practically bare, while the northerly half is wooded.

Kailu Point, the extreme northwesterly point of **Kauai**, is the seaward end of a jagged ridge, which ends abruptly in a sharp peak about 150 feet high. There is a narrow strip of lowland at the point.

Aulomapoko Point, $1\frac{1}{8}$ miles eastward of **Kailu Point**, is low and rounding. About $\frac{1}{4}$ mile southward of the point is a small white church with spire.

Wainiha Bay, $1\frac{1}{4}$ miles eastward of **Aulomapoko Point**, is an open bight in the mouth of a deep valley affording no protection except during easterly trades and kona weather. The local steamers call to load and discharge. There is a wharf on the southwesterly side of the bay just eastward of a steep, rocky point. There are reefs in the bay, the positions of which can not be given, as no survey has been made.

Kolokolo Point, marking the easterly entrance to **Wainiha Bay**, is low. **Lumalai River** is just eastward of the point.

Makahoa Point is a black, rocky point on the west side at the entrance to **Hanalei Bay**. Back of the point is a high, green hill.

Hanalei Bay, about 1 mile eastward of **Wainiha Bay**, is about 1 mile wide between **Makahoa Point** and **Puupoa Point** and indents the coast about the same distance. A coral reef about $\frac{1}{4}$ mile wide, over which the sea generally breaks, fringes the shore on both sides. The beach at the head of the bay is sandy. Enter midway between the two entrance points on a 157° true (SE by S mag.) course, heading for the church, which shows a white steeple above the trees, and anchor in 6 fathoms, sandy bottom, about $\frac{1}{2}$ mile from shore. During northerly or northwesterly gales the sea breaks across the entrance of the bay. **Hanalei River** empties into the bay about $\frac{1}{2}$ mile inside the easterly entrance point, and is navigable for boats. The landing is just inside its mouth. **Waioli River** empties into the westerly part of the bay, but its mouth is generally closed by a bar. The village is scattered along the beach, behind which the mountains rise to an elevation of about 4,000 feet, and on account of the frequent

rains are covered with vegetation. The land between Kailiu Point and Hanalei Bay is used chiefly for the cultivation of rice.

Puupoa Point, on the easterly side of the entrance to Hanalei Bay, is a bluff about 50 feet high, back of which a green ridge makes inland.

From offshore the northerly side of Kauai presents a very irregular and jagged sky line, with ridges running in every direction. In the northwesterly part of the island these ridges often end abruptly at the sea. The mountains are heavily wooded.

The coast between Hanalei and Kalihiwai Bays is a series of more or less wooded bluffs, much cut up by gulches, back of which a rolling plain extends to the mountains and is used chiefly for grazing.

Kalihiwai Bay, about 5 miles eastward of Hanalei Bay, is marked on its easterly side by **Pukamoe Point**, a red, precipitous bluff about 150 feet high. The bay is about $\frac{1}{2}$ mile in diameter, and there are several houses scattered along the sand beach at its head. The gulch at the head of the bay is wooded. An indifferent anchorage, with poor holding ground, can be found in 5 fathoms near the head of the bay, but during northerly winds a heavy swell sets in.

Kilauea Point, about $1\frac{1}{2}$ miles eastward of Kalihiwai Bay, is a high bluff, and is marked by **Mokuaeae Rock**, a black rock about 100 feet high, which lies about 200 yards offshore, and **Kilauea Point Light house**. **Kilauea sugar mill** lies about $1\frac{1}{4}$ miles southward of **Kilauea Point**. It can not be seen when close inshore.

Between **Kilauea Point** and **Mokolea Point**, which lies about $1\frac{1}{4}$ miles southeastward, the coast is bluff, rising gradually from each point to an elevation of about 500 feet about midway between them. A black rock about 150 feet high lies close to shore just eastward of the highest point of the bluff.

Mokolea Point is a high, sharp point, near the seaward end of which are two red houses and a derrick for handling freight.

Kilauea Bay is an open bight just eastward of **Mokolea Point**. The local steamers load sugar here by means of a wire cable. **Kilauea River** empties into the westerly part of the bay.

Kapuhi Point is a low, narrow point about $1\frac{3}{8}$ miles eastward of **Mokolea Point**.

Moloaa Bay, about $1\frac{1}{2}$ miles southeastward of **Kapuhi Point**, is a small open bay about $\frac{1}{4}$ mile in diameter in the mouth of a gulch. It is not surveyed, and without local knowledge should not be attempted. There are a few houses on the sand beach at the head of the bay.

Papaa Bay, about $1\frac{1}{2}$ miles southeastward of **Moloaa**, is a bight open to the trade winds. It is not surveyed, and without local knowledge should not be attempted. Between **Kalihiwai Bay** and **Moloaa Bay** the land is planted in sugar cane, and between the latter bay and **Anahola Bay** it is used for grazing.

Anahola Bay, $1\frac{3}{8}$ miles south-southeastward of **Moloaa Bay**, is marked on its southerly side by **Kahala Point light**. It is a small bight exposed to the trades, and on account of numerous reefs should not be attempted by strangers. The small local steamers anchor off the end of the wharf, which is on the south side of the bay. Near the inshore end of the wharf is a large white shed and several small houses. About $\frac{1}{4}$ mile westward of the wharf are two range poles, maintained by private parties. The front range is taller than

the rear one, and consists of a mast, with a crosspiece near its top. The rear range is a mast with a disk near its top. These masts in range lead into the bay. A gray church, with red roof and steeple, is $\frac{1}{4}$ mile inland on the southwesterly side of the bay. Near the latter can be seen a few houses. **Konanae Hill**, about $1\frac{1}{4}$ miles westward of Anahola Bay, is the most prominent mountain peak in this part of the island. It is about 1,430 feet high and marks the seaward end of a range of conspicuous peaks which extend well into the interior of the island. Approaching from northward, a natural arch can be seen, which looks like a small white house high up under the ridge.

Off **Kuaehu Point**, the northerly point of Anahola Bay, the water is discolored for a distance of about $1\frac{1}{2}$ miles offshore, and until the locality is surveyed it is recommended that vessels give the point a berth of about 2 miles.

Kealia Anchorage, about 3 miles southward of Kahala Point, is marked by a breakwater which extends about 600 feet offshore in a southeasterly direction. The boat landing is on the southwesterly side of the breakwater. The local steamers calling here find an indifferent anchorage, and vessels without local knowledge should not attempt it. About $\frac{1}{4}$ mile westward of the anchorage is a sugar mill and plantation settlement.

Kapaa, $1\frac{1}{4}$ miles southward of Kealia Anchorage, is a large village scattered along the beach. The northerly end of the village is marked by a tall, gray brick chimney, and its southerly end is marked by a church with steeple.

Wailua is a small village $2\frac{1}{2}$ miles southwestward of Kapaa village. It consists of a few houses located on both sides of the mouth of the Wailua River, a little distance back from the sand beach. The river is navigable for boats for several miles after passing the bar.

Hanamaulu Bay, 3 miles southward of Wailua, is marked on its southerly entrance point by a red light, maintained by private parties, shown from a small wooden tower. The bay is about $\frac{1}{4}$ mile wide and indents the coast about $\frac{1}{2}$ mile, but the greater part of it is shoal. It affords good protection for small vessels, except during northeasterly winds. There is a wharf just inside the southerly entrance point, and a depth of 24 feet can be taken to its end. This is the only wharf on the island to which the steamers make fast. Near the inshore end of the wharf is a long, low warehouse, southward of which is a thick grove of trees. A gorge makes inland from the head of the bay, and a short distance inland it is spanned by a high trestle. The entrance to the bay is free of obstructions, and by giving the southerly entrance point a berth of at least 150 yards vessels can enter and anchor in 6 fathoms just inside the southerly entrance point, in the vicinity of the mooring buoys, which lie off the end of the wharf.

About 1 mile westward of Hanamaulu Bay is **Kalepa Peak**, about 700 feet high, the southerly end of a low range of reddish-brown hills, which parallel the coast northward for a distance of about 4 miles. **Nonou Peak**, about 1,240 feet high, is near the northerly end, and is the highest and most prominent peak of the range. Just southward of Kalepa Peak is a large white sugar mill and plantation settlement. At night the electric lights of this mill are often seen before Nawiliwili light is sighted.

Between Anahola Bay and Nawiliwili Bay the coast consists of a series of low bluffs cut up by gulches, with here and there stretches of sand beaches. The land back of this section of the coast is used for the cultivation of sugar cane.

Kumukahi (Niihau) Channel lies between Kauai and Niihau, and is about $14\frac{1}{2}$ miles wide and clear of obstructions. The trade winds follow the south coast of Kauai, and off Mana Point meet the air current that has followed around the northerly side. The trade winds blow directly across the lowlands of Niihau, but part of it is deflected southward and around the southeast point of Niihau.

CURRENTS.—It is almost impossible to lay down any rules for the current, which sometimes sets southward along the east coast of Niihau at the same time that it is setting northwestward along the southwesterly coast of Kauai. During kona weather these conditions are changed.

NIIHAU,

the seventh in size of the islands, is at the westerly end of the group. It is about 16 miles long in a northeasterly direction and varies in width from about 3 to 5 miles. The island is low at both ends, but near the middle part of it there is a high table-land, with low projecting peaks, near the northerly end of which there is an elevation of about 1,300 feet. The northerly and easterly ends of the table-land are precipitous, varying in height from 600 to 1,000 feet, while the southerly and westerly slopes are more gradual. There are no streams on the island. The island is entirely devoted to stock raising. The census of 1910 gave Niihau a population of 208 inhabitants.

Pueo Point, the easternmost point of Niihau, is a prominent, brown, precipitous bluff about 900 feet high.

From Pueo Point southwestward the high, precipitous bluffs are a feature of the coast for about $4\frac{1}{2}$ miles, when they then turn inland; thence to Cape Kawaihoa the bluffs along the shore are much lower.

Cape Kawaihoa, the southeasternmost point of Niihau, is formed by a hill about 600 feet high, which is precipitous on its seaward face. There is deep water close to the cape.

Between the table-land heretofore mentioned and the southerly end of the island the country is a low, rolling plain, near the center of which is **Kawaewae**, a prominent, low, rounded, brown hill, with a flat top.

From Cape Kawaihoa the coast gradually curves westward and northward. It is low and rocky, with sand beaches in places.

Kamalino is a small village located on a small bight about $4\frac{1}{2}$ miles northwestward of Cape Kawaihoa.

From Kamalimo to a point abreast of Lehua Island the coast is low, and is practically one continuous sand beach, with an occasional clump of black rocks. Near the beach are numerous sand dunes covered with vegetation. The country back of the coast is low, with small groves of trees in places. There are no harbors, although it is probable that an anchorage can be found almost anywhere during the trade winds.

Nonopapa Anchorage, 2 miles northward of Kamalino, is marked by a low, brown shed standing close to shore at the northerly end of a long sand beach. On the beach, immediately in front of shed, is a

derrick. The prominent brown hill (Kawaewae), heretofore mentioned, lies about $1\frac{1}{2}$ miles 135° true (SE $\frac{1}{8}$ E mag.) of the anchorage. When making for an anchorage, bring Kao Cone in range with the shed on the bearing 70° true (NE by E $\frac{3}{8}$ E mag.), and stand in until in the desired depth. Kao Cone is a low cone near the center of the tableland, and on this bearing appears to be the highest point. At times a heavy swell makes landing very dangerous.

About $1\frac{1}{4}$ miles northward of the landing at Nonopapa and $\frac{1}{4}$ mile inland a large dwelling with outhouses is located on a hill in a grove of trees.

A reef, over which the sea generally breaks, extends about $\frac{1}{2}$ mile offshore at a point about $1\frac{1}{2}$ miles northward of Nonopapa. A black rock shows above water at the outer end of the reef, but vessels are cautioned to give it a berth of at least $\frac{1}{4}$ mile.

Dangers.—A shoal, which breaks only in a heavy sea, is reported to lie about $6\frac{1}{2}$ miles 236° true (SW $\frac{1}{8}$ W mag.) of Lehua Island. Between this island and the shoal there is much foul ground, and strangers are cautioned to give this locality a wide berth.

Lehua Island, about $\frac{1}{2}$ mile northward of Niihau, is a small, rocky, crescent-shaped island, open northward. The easterly and westerly points are low, rising gradually to an elevation of about 438 feet near the center of the island. On the westerly point of the island there is a natural arch. Foul ground extends well north and east of the island.

The channel between Niihau and Lehua is restricted on its southerly side by rocks showing above water, which extend about halfway across it. Vessels with local knowledge can find a channel with good water close to the southerly and southeasterly shore of Lehua.

The northerly coast of Niihau is low, and off Kikepa Point there are several black rocks showing above water. Between this coast and the high precipitous bluffs marking the northerly side of the tableland the land is low.

From Kikepa Point to Oku Point, a distance of about $1\frac{3}{4}$ miles, the coast is low and has a general southeasterly trend.

Kaunopou Rocks, showing above water, lie close to shore $\frac{1}{4}$ mile southward of Oku Point.

From Kaunopou Rocks the coast trends westward for about $\frac{1}{2}$ mile to Kii Anchorage, where the local steamers anchor in about 5 fathoms during kona weather.

From Kii Anchorage to Pueo Point, a distance of about 5 miles, the coast has a general southerly trend. From Kii Anchorage southward for 2 miles the coast is low and sandy, and thence to Pueo Point it consists of high, precipitous bluffs. The entire easterly coast is practically free of outlying dangers, and by giving it a berth of 1 mile all dangers will be avoided.

Kaula, about 19 miles southwestward of Niihau, is a small, bare, rocky islet about 900 feet high.

NIHOA OR MODU MANU (BIRD ISLAND)

is a barren, rocky island lying about 140 miles $296^\circ 30'$ true (WNW $\frac{5}{8}$ W mag.) of the westerly end of Kauai, in latitude $23^\circ 05' 50''$ N, longitude $161^\circ 58' 17''$ W. The island is about $\frac{3}{4}$ mile long and

averages a little more than $\frac{1}{4}$ mile in width. The easterly, northerly, and westerly sides of the island are high and precipitous, while the southerly side is much lower, and its slopes are more gradual. The greatest elevation is Millers Peak, near the northwesterly end of the island, which is 903 feet high. The peak near the northeasterly end is 869 feet high.

The best anchorage can be found in **Adams' Bay**, on the southerly side of the island, about 450 or 500 yards offshore. The bay consists of three small bights, the westerly one having a sand beach and the other two are rocky. The best landing is in the middle bight. However, it should not be attempted except in smooth weather. The island is uninhabited, and no water can be obtained. Nihoa is near the southwesterly end of a bank which is about 20 miles long and about 11 miles wide, with depths of 20 to 40 fathoms. Another bank, with depths of 20 to 30 fathoms, lies 3 miles west-southwestward; this bank is about 16 miles long and 10 miles wide. The edges of these banks break down steeply to great depths.

FROST SHOAL

lies about 90 miles $296^{\circ} 30'$ true (WNW $\frac{5}{8}$ W mag.) of Nihoa, in latitude $23^{\circ} 45' N$, longitude $163^{\circ} 25' W$. This shoal is about 14 miles long in an easterly direction, with depths of 12 to 63 fathoms. It has not been surveyed and vessels are cautioned to give the locality a wide berth.

NECKER ISLAND

is a rocky island lying about 155 miles 281° true (W mag.) of Nihoa, in latitude $23^{\circ} 35' 30'' N$, longitude $164^{\circ} 39' 58'' W$. The island has four peaks, 235 to 300 feet high, one near each end and two between them, connected by a ridge. The sides of the island are precipitous, with 5 to 8 fathoms alongside. **East Cove** and **West Cove** are the only places where a landing can be made, and then it is only possible in fine weather. Detached rocks, about 10 feet high extend about 100 yards eastward from the easterly end of the island. Anchorage can be had anywhere under the lee of the island, in 8 to 15 fathoms, about $\frac{1}{2}$ mile offshore. Necker Island is surrounded by a bank with 14 fathoms and upward, the extent of which is not accurately known; the most probable limits are 15 miles northeastward, 30 miles southeastward, 5 miles southwestward, and 7 miles northwestward. Except on the northeast side, the edges of the bank are abrupt.

TIDE.—The rise and fall of the tide is about 2 feet.

CURRENT.—A current sets westward on the north side of the island and circling around sets eastward on the south side.

WINDS.—September is said to be the calmest month in the year; strong north and northeast winds are said to be frequent during the other months.

FRENCH FRIGATE SHOAL,

lying 90 miles 278° true (W $\frac{1}{4}$ S mag.) of Necker Island, is a crescent-shaped atoll with a number of sand islets on it. A rocky islet about 180 feet long, 45 feet wide, and 120 feet high, lies about midway between the points of the crescent, in latitude $23^{\circ} 46' N$,

longitude $166^{\circ} 18' W$. The islet is so steep and rugged that it is almost inaccessible. It is visible for about 8 miles and from a distance resembles a brig under sail. The points of the crescent, as indicated by the ends of the line of breakers, bear 166° true (SSE $\frac{1}{4}$ E mag.) and 310° true (NW by W $\frac{3}{8}$ W mag.) from the rocky islet. Water, somewhat brackish, but not unwholesome, has been found by digging wells 8 to 10 feet deep on the sand islets.

ANCHORAGE can be had anywhere inside the reef in from 5 to 15 fathoms, coral and sandy bottom. There is an excellent anchorage about one mile northwestward of the rocky islet, in 13 to 14 fathoms, well protected. The rocky islet can be approached within 200 yards by vessels of any size with safety.

DIRECTIONS.—Entering from southward, head for the rocky islet on a 0° true (N by W mag.) course, passing between the southern horn and the breakers reported 3 miles westward of it. Entering from westward, head for the rocky islet on a 124° true (ESE mag.) course. Apparently there are no dangers outside the line of breakers; however, a sharp lookout is advisable.

CURRENT.—The current in this vicinity sets southwestward.

BROOKS SHOAL,

lying 30 miles 304° true (WNW mag.) of French Frigate Shoal, appears to be an oblong bank about 14 miles long in a west-north-westerly direction, on which a least depth of 14 fathoms has been found. The approximate geographic position of the shoal is latitude $24^{\circ} 10' N$, longitude $166^{\circ} 53' W$. Soundings taken over the shoal indicate that the bottom is very irregular, with deep holes in places. In 1910 soundings with a least depth of 18 fathoms were found north-westward of Brooks Shoal in latitude $24^{\circ} 29' N$, longitude $167^{\circ} 12' W$.

GARDINER ISLAND

is a rocky island lying 120 miles 309° true (NW by W $\frac{1}{2}$ W mag.) of the rocky islet at French Frigate Shoal, in latitude $25^{\circ} 01' N$, longitude $167^{\circ} 59' W$. It is an inaccessible rock 170 feet high and 200 yards in diameter, with a smaller rock close to its southwesterly extreme, from which a reef extends about $\frac{1}{2}$ mile. A bank, with 17 to 20 fathoms, surrounds the rock, extending about 5 miles north-westward, northeastward, and southeastward, and from 10 to 12 miles southwestward.

TWO BROTHERS REEF

(existence doubtful) is placed on the charts in latitude $24^{\circ} 14' N$, longitude $168^{\circ} 28' W$. It is reported as having been struck by a whaling ship in 1823. Several vessels have searched for the reef without finding it, and great depths were obtained at its reported position.

DOWSETT REEF,

lying 133 miles 278° true (W $\frac{1}{4}$ S mag.) of Gardiner Island, is a rectangular coral reef, the center of which is in latitude $25^{\circ} 20' N$, longitude $170^{\circ} 30' W$. The reef is about 9 miles long in a westerly direction and about 5 miles wide. It is awash in places and is generally entirely covered by breakers. The bank surrounding the reef on which are 10 to 20 fathoms, extends from 5 to 10 miles off.

MARO REEF,

lying about 10 miles northwestward of Dowsett Reef, is also rectangular, its center being in latitude $25^{\circ} 29' N$, longitude $170^{\circ} 35' W$. The reef is about 9 miles long in a westerly direction and about 5 miles wide. It is generally covered with breakers, the heaviest being near the northwesterly end. The reef is nearly surrounded by a bank on which are soundings of from 10 to 30 fathoms, extending from 2 to 7 miles off, and deepening gradually from the reef. Both Dowsett and Maro Reefs should be approached with caution, the breakers at times being very light and scarcely distinguishable from whitecaps.

LAYSAN ISLAND

is a small, low island lying about 65 miles 280° true ($W \frac{1}{8} S$, mag.) of Maro Reef, in latitude $25^{\circ} 42' 14'' N$, longitude $171^{\circ} 44' 06'' W$. The island is about $1\frac{3}{4}$ miles long, 1 mile wide, 55 feet high, and covered with scrub. Near the center of the island there is a salt-water lagoon about 1 mile long.

Water of tolerable quality may be obtained from shallow wells, and sea fowl, eggs, and fish are abundant.

The island is surrounded by a fringing reef from 100 to 500 yards in extent, outside of which is a bank about 6 miles wide, with from 14 to 60 fathoms, beyond which the water deepens rapidly. No dangers exist beyond the line of breakers. Inside the fringing reef there is a narrow boat passage nearly around the island, with an opening on the west side large enough to admit the passage of lighters to the landing. Vessels can only visit this island with safety between the months of April and September, when the northeast trades prevail.

ANCHORAGE may be found anywhere on the westerly side of the island, about $\frac{1}{2}$ mile offshore, in 8 to 12 fathoms, rocky bottom. The holding ground is poor.

CURRENT.—The current appears to set northward and westward. Close to the island the current is affected by tidal action. The wind has a strong effect on the current, and with a sudden change the current may shift almost as quickly.

LISIANSKY ISLAND

is a small, low coral island lying about 117 miles 279° true ($W \frac{1}{8} S$ mag.) of Laysan Island, in latitude $26^{\circ} 00' N$, longitude $173^{\circ} 50' W$. The island is about 1 mile long, $\frac{1}{2}$ mile wide, 44 feet high, and overgrown with bushes. Brackish water, barely drinkable, may be obtained by digging a few feet, and birds, fish, and turtle are abundant.

The island is encircled by a reef, which, on the westerly side, forms a lagoon $2\frac{1}{2}$ miles wide in which there is good anchorage in from 3 to 6 fathoms. The island should be visited only between the months of April and September, inclusive. The principal entrance to the lagoon is marked by two heavy breakers bearing north and south from each other, $\frac{3}{4}$ mile apart, and about 2 miles westward of the island; between these two breakers are several small rocks awash, which may be avoided by conning from aloft; inside the lagoon are a number of scattered rocks, but as the water is smooth they are easily avoided. The best anchorage for vessels drawing 13 feet or less is $\frac{1}{4}$ mile offshore, in 3 fathoms, sandy bottom.

The approach should be made from northward. When about 5 miles distant from the island, depths of 18 to 20 fathoms will be found, with large coral bowlders on the bottom distinctly visible. Steer westward skirting the edge of the reef, which at this point is a fairly continuous coral ledge, until the south end of the island bears 96° true (E $\frac{1}{2}$ N mag.) when the entrance, heretofore described as being marked by two heavy breakers, having a depth of 4 fathoms, will be plainly visible.

Neva Shoal is a dangerous reef lying $1\frac{1}{2}$ miles east-southeastward of the southeasterly end of the island. A submerged rock, marked by breakers, is reported to lie $2\frac{1}{2}$ miles 244° true (SW $\frac{3}{4}$ W mag.) of the southwesterly end of the island.

Lisiansky Island is surrounded by the usual bank, with no outlying dangers, to a distance of 5 or 6 miles, except southward and eastward, in which direction a dangerous bank, covered with sand and coral reefs, extends about 30 miles. In 1900 a vessel struck at a point 12 miles southeastward of the island and remained entangled 14 days by the reefs and shoals. Vessels should give the island a wide berth when passing southward of it.

TIDES.—The rise and fall of the tide is about 1.5 feet, much influenced by the winds.

CURRENT.—During the winter months strong northwesterly currents prevail.

PEARL AND HERMES REEF,

lying about 155 miles 315° true (NW by W mag.) of Lisiansky Island, is an extensive atoll about 40 miles in circumference, 16 miles long in an easterly direction, and 9 miles wide, on which are scattered 12 small, low islands and islets, forming a crescent open northward. Southeast Island is in latitude $27^{\circ} 48' N$, longitude $175^{\circ} 51' W$.

Inside the lagoon the, only entrance to which is on the northwesterly side, through which there is 1 to 6 feet with numerous coal heads, there is an anchorage in 3 to 15 fathoms, but the islands can not be approached within 2 miles; the largest island bears 119° true (ESE $\frac{3}{8}$ E mag.) from the entrance, and is covered with grass and low trees. Vessels can anchor outside the reef, on the northwesterly side near the entrance, in 8 to 12 fathoms.

The reef is steep-to on the easterly side, the 100-fathom curve being within 300 yards of the reef; but on the westerly side it slopes off gradually to 35 fathoms, and then deepens very suddenly. There are no known dangers outside the breakers.

Turtle and fish are abundant.

CURRENT.—The current appears to set northward between Lisiansky Island and Pearl and Hermes Reef.

GAMBIA BANK,

lying about 35 miles 293° true (WNW $\frac{7}{8}$ W mag.) of Pearl and Hermes Reef, in latitude $28^{\circ} 07' N$, longitude $176^{\circ} 38' W$, has 14 fathoms over it and the bottom can be plainly seen.

MIDWAY ISLANDS

is a circular atoll about 6 miles in diameter, inclosing two islands. The narrow encircling reef is about 5 feet high in places, and is almost continuous, except on the westerly side from its northwest end to Seward Roads. On this side is a flat, near the westerly edge of which are North Breakers and Middle Ground, which break continually. The whole of the barrier reef is fairly steep-to and should be given a wide berth at night.

Eastern Island, at the southeast end of the reef, is $1\frac{1}{4}$ miles long, 6 to 12 feet high, and covered with shrubbery and coarse grass; it has a white sand beach, except its eastern point, which is coral rock. **Sand Island**, on the southerly side of the reef, is $1\frac{3}{4}$ miles long and composed of white coral sand; it has a greatest elevation of 43 feet in its northerly part. On the north side are the buildings of the cable station, and on the summit of the island is Midway Islands light, in latitude $28^{\circ} 13' 15''$ N, longitude $177^{\circ} 21' 30''$ W.

Welles Harbor is the gap in the barrier reef on the west side of the atoll, and is safe in the summer, when the northeast trades blow steadily. From October to April gales are of frequent occurrence, with always a rough westerly sea and the bar breaking almost constantly. The entrance and harbor are of coral formation, and there are numerous coral reefs and heads, which rise abruptly a few feet above the surrounding sandy bottom. Inside the reefs there is a bar of rocks and boulders, with depths of 12 to 17 feet, which is dangerous in westerly and southwesterly weather. The deepest draft entering the harbor is about 15 feet.

The northern side of the entrance to Welles Harbor is marked by **North Breakers**, a reef awash at low water, on which the sea always breaks; $\frac{1}{2}$ mile northward of it is **Middle Ground**, on which the sea generally breaks. The entrance is $\frac{1}{2}$ mile wide between North Breakers and the cays on the reef forming the southern side, but its navigable width is much reduced by shoals on either side.

RANGES.—Seward Roads range beacons, on sand dunes on the southerly part of Sand Island, lead through Seward Roads on a 142° true (SE $\frac{1}{4}$ E mag.) course to the bar, where the range intersects the Welles Harbor range. The range leads only 100 feet from the end of the shoal surrounding North Breakers, and care should be taken to go nothing northward of it when passing the shoal. It is also well to keep a little southward of the range on approaching the bar until on the Welles Harbor range.

The front beacon is a black wooden triangle, apex up, marked with a white cross, and surmounted by a pole with horizontal cross-piece. The rear beacon is a black pole with two boards crossed windmill fashion.

Welles Harbor range beacons, on the northerly part of Sand Island, lead in the best water across the bar and through Welles Harbor to the black and white perpendicularly striped buoy nearly $\frac{3}{8}$ mile inside the bar, course $114^{\circ} 30'$ true (ESE $\frac{3}{4}$ E mag.). A spot with 15 feet over it lies in Seward Roads on the range line, with the right tangent of the outer reef on the south side of the entrance bearing about 200° true (S $\frac{1}{8}$ W mag.), and there are numerous shoal spots and foul ground southward of the range to the reef.

The front beacon is a black wooden triangle, apex up, with a white diamond in the center, located on the southerly edge of a group of five sand dunes. The rear range is Midway Islands Light structure, consisting of a white house and mast, located on the summit of Sand Island.

CABLE.—The cable between San Francisco, Honolulu, Guam, and Manila touches at Midway Islands. To avoid fouling the cables in Seward Roads, vessels should anchor northward and not within 200 yards of the Welles Harbor range line.

ANCHORAGE.—A mooring buoy with heavy anchor is maintained in the basin in the northerly part of Welles Harbor. The anchorage with best swinging room is in the middle of the basin, southward of the buoy, in about 6 fathoms, but more exposed in westerly weather. The bottom in Welles Harbor is sand, except where otherwise marked on the chart, and is poor holding ground.

The best and most convenient anchorage to the landing, which is on the north side of Sand Island, is in the middle of the basin in the eastern part of the harbor, a little over $\frac{1}{2}$ mile westward from the northwest end of Sand Island, in $4\frac{3}{4}$ fathoms. There is scant swinging room for a vessel of any size.

OUTSIDE ANCHORAGES.—In Seward Roads, outside the bar of Welles Harbor, there is good anchorage in favorable weather in $4\frac{1}{2}$ to 5 fathoms, picking out a sandy spot to drop the anchor. Outside of North Breakers anchorage can be selected in 6 to 12 fathoms, choosing any one of the numerous sandy spots, the bottom anywhere about the island being visible up to 10 fathoms. To avoid the cables, keep the south end of North Breakers bearing eastward and southward of 90° true (E $\frac{7}{8}$ N mag.).

Anchorage can be had in other places outside the atoll, except on its northeast and southwest sides. The best, so far as bottom is concerned, is southward of the west end of Eastern Islands, where a good place to drop the anchor can be chosen by inspection of the bottom. With a smooth sea there is a boat passage, with a depth of 12 feet, through the reef westward of Eastern Island, and a depth of 5 to 10 feet, thence to the northeast end of Sand Island.

SUPPLIES.—Fish and birds can be obtained, and water can be had on Sand Island by digging about 5 feet.

WINDS.—During the summer months the winds are generally variable and light, either from northeast, southeast, or southwest until about the middle of July, when fresh to strong northeast trades set in and continue through July and August. Southwest winds are always accompanied with a low barometer and rain and squalls, but rain also occasionally comes with northeast and southeast winds and a high barometer. Northwest winds following southwest storms generally indicate clearing weather. During the winter months, from October to April, gales frequently occur, working around from southeast through southwest to northwest, with occasionally a few days of fine weather, but always a rough westerly sea.

TIDES.—The mean range of tide at Midway Islands is 0.9 foot.

CURRENTS.—There is generally little current in Welles Harbor; what little there is usually setting westward. It is reported that during heavy gales the harbor is full of strong currents, caused by the sea being forced over the reefs. The current outside generally sets northward on either side of the atoll, and with the ebb tide it slackens and sometimes reverses.

SAILING DIRECTIONS, MIDWAY ISLANDS.

The encircling reef is steep-to on all sides, and there are no outlying dangers. There is shoaler water, however, off the northwest side, and less to mark it in that locality, and that portion should be approached with caution. The structures on Sand Island may be seen about 12 miles under favorable conditions. The islands should never be approached at night.

In Welles Harbor the best guide in general is the coral heads, which, except in cloudy weather, can be easily seen, showing as dark purple against the bright blue or green of the sand, and they are always steep-to.

Approaching the entrance through Seward Roads, be guided by the ranges (see the description preceding), keeping southward of the Seward Roads range to avoid the shoal making off from North Breakers, and northward of the Welles Harbor range to clear the 15-foot spot on the range and the broken ground making off from the reef on the south side of the entrance.

Crossing the bar, keep close on the Welles Harbor range, as the channel is less than 200 feet wide between spots with 12 and 16 feet over them. Continue on the range, course $114^{\circ} 30'$ true (ESE $\frac{3}{4}$ E mag.), and when about $\frac{1}{4}$ mile inside the bar pass between two coral heads with 12 and 14 feet and a channel 200 feet wide between them. After passing these heads and up with the black and white perpendicularly striped can buoy, stand northeastward to the mooring buoy or to an anchorage with swinging room southward of it.

Or, when nearly up with the can buoy turn southward and pass westward of the Hook (a large coral patch, from which a shoal extends about 200 feet). Then haul eastward and steer for the rear beacon of the Welles Harbor range, just open to the left of the dune southward of the front beacon, course 109° true (E $\frac{3}{4}$ S mag.). Pass northward of several small coral heads (least depth 11 feet), and anchor near the last range, near the middle of the basin, in $4\frac{3}{4}$ fathoms, sandy bottom.

Bank near Midway Islands.—In 1899 a bank with 82 fathoms over it was discovered 35 miles southwestward of Midway Islands, in latitude $27^{\circ} 58' N$, longitude $177^{\circ} 55' W$.

OCEAN (CURE) ISLAND,

lying about 56 miles 280° true (W mag.) of Midway Islands, in latitude $28^{\circ} 25' N$, longitude $178^{\circ} 25' W$, is an atoll closely resembling Midway Islands in both formation and appearance. The atoll is about 15 miles in circumference, is somewhat oval in shape, and incloses a lagoon, the entrance of which is about 1 mile wide. This entrance is on the southwesterly side and is shallow. No dangers have been observed outside the reef.

Green Island, in the southeasterly part of the lagoon, is about 20 feet high, covered with small shrubs, and similar to Eastern Island, of the Midway Islands. Westward of it are two small sand islets. The westerly one is the largest, and is about 10 feet high.

A bank with 20 to 30 fathoms surrounds the island and extends off shore about 1 mile. The best anchorage is on the westerly side, near the northwesterly point of the breakers, in 8 to 12 fathoms, rocky bottom. From the appearance of the islands it may be as-

sumed that they are sometimes visited by severe storms, the sand being thrown into numerous cones and pyramids.

A bank (position doubtful) is placed on the charts in latitude $30^{\circ} 55' N$, longitude $177^{\circ} 30' E$. The chart gives a depth of 42 fathoms. In 1901 and 1902 this position was sounded over, and no bottom was found at 100 fathoms.

CURRENTS.—A set to the southward has been observed between Ocean and Midway Islands.

JOHNSTON (CORNWALLIS) ISLAND

is a lagoon island, the reef being about 8 miles long in a northeasterly direction, with its edges well defined by breakers at both ends and along its northwesterly side. On the reef are two islets. The larger (Johnston Island) is the southwesterly one, and is $\frac{1}{2}$ mile long in a east-northeasterly direction; its easterly end is in latitude $16^{\circ} 45' N$, longitude $169^{\circ} 30' W$. The smaller one (Sand Islet) is a mere sand bank about 500 yards in diameter, lying 1 mile northeastward of Johnston Island. Both islands are grass covered.

BREAKERS extend northward nearly $1\frac{1}{2}$ miles, and a bank surrounds the reef, extending in a southeasterly direction 5 or 6 miles, having on it depths of 5 to 10 fathoms, though many shoaler patches were seen.

APPROACH.—The only safe line of approach is to head for the easterly end of the large (Johnston) Island on a 335° true ($NW \frac{7}{8}$ N mag.) course. On this course the edge of the reef will be found in 7 fathoms about 5 miles from the island, with irregular depths of $5\frac{1}{2}$ to 12 fathoms, until within 1 mile of the island, when an anchorage can then be had. On this course shoal spots, with apparently as little as 4 fathoms over them, can be seen on both sides. On account of numerous coral heads with little water over them, vessels should not attempt to go in closer than 1 mile from shore. The anchorage is sheltered from the northeast trades, but is exposed to winds from east round through south to west-southwest.

TIDES.—It is high water, full and change, at 3 hours 15 minutes; mean range a little less than 2 feet.

LANDING.—The landing is bad, but small boats can reach the beach at high water.

SCHJETMAN REEF.

(Existence doubtful.) A breaking coral reef, level with the surface, was reported in 1868 as having been sighted in latitude $16^{\circ} 08' N$, longitude $178^{\circ} 58' W$. The reef appeared to be about $1\frac{1}{2}$ miles long in a northerly direction and about $\frac{1}{2}$ mile wide. This reef was searched for in 1880, but could not be found.

KRUSENSTERN ROCK

(position doubtful) was reported as a breaker in 1804, in latitude $22^{\circ} 15' N$, and longitude $175^{\circ} 37' W$. Capt. R. Suffern, of the bark *Craigerne*, reported that on June 25, 1897, his ship was on the exact position assigned to the rock, and although the weather was clear and the sea smooth, no indications of either rock or shoal water could be seen from the masthead. In 1901 breakers were reported in latitude $21^{\circ} 55' N$, and longitude $176^{\circ} 05' W$, or about 35 miles southwestward of the charted position of Krusenstern Rock.

COAST AND GEODETIC SURVEY CHARTS OF HAWAIIAN ISLANDS.

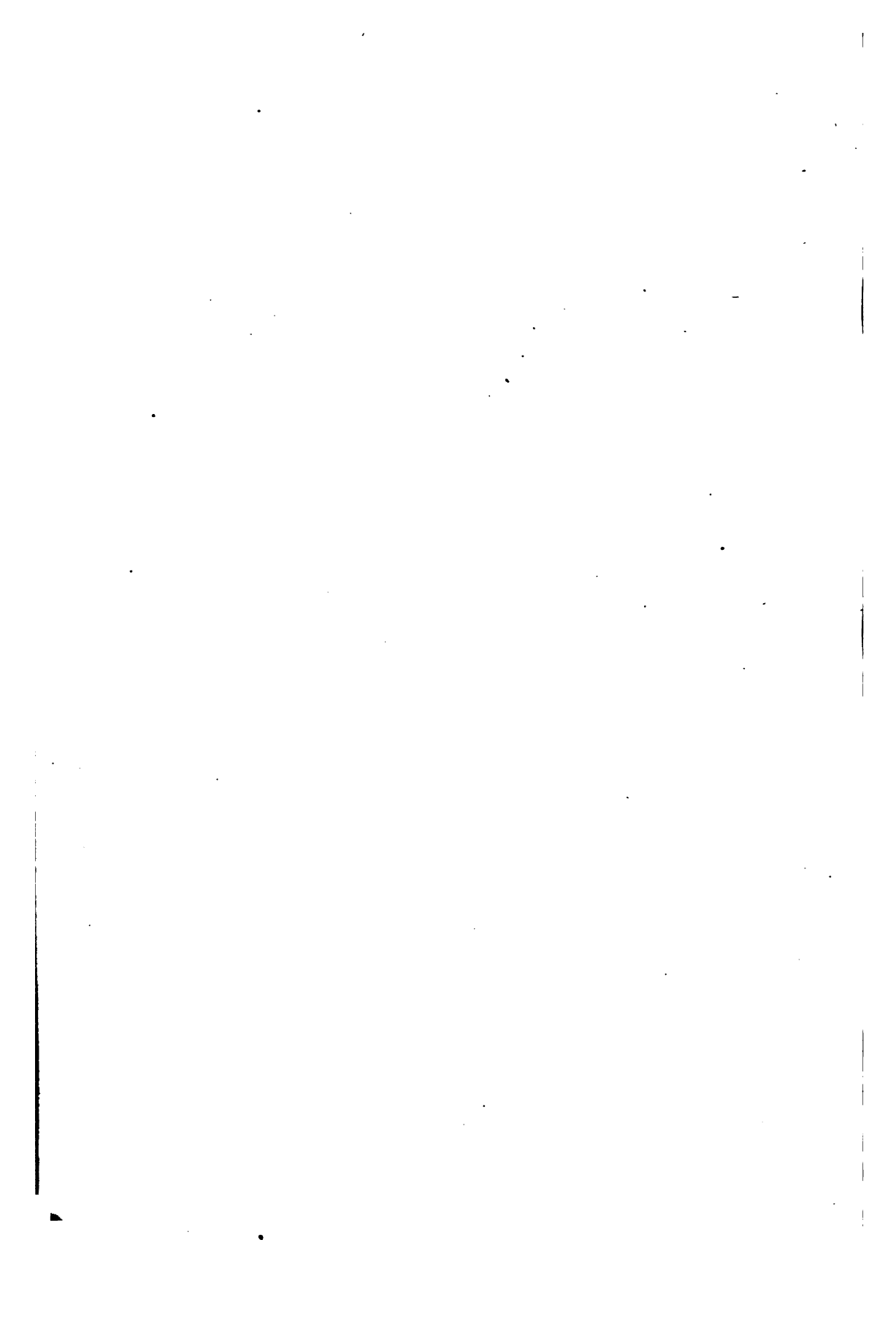
	Price.
4102. Hawaiian Islands.....	\$0. 50
4115. Hawaii.....	. 50
4116. Maui to Oahu.....	. 50
4117. Oahu to Nūhau.....	. 50
4101. Mahukona Harbor, Hawaii.....	. 20
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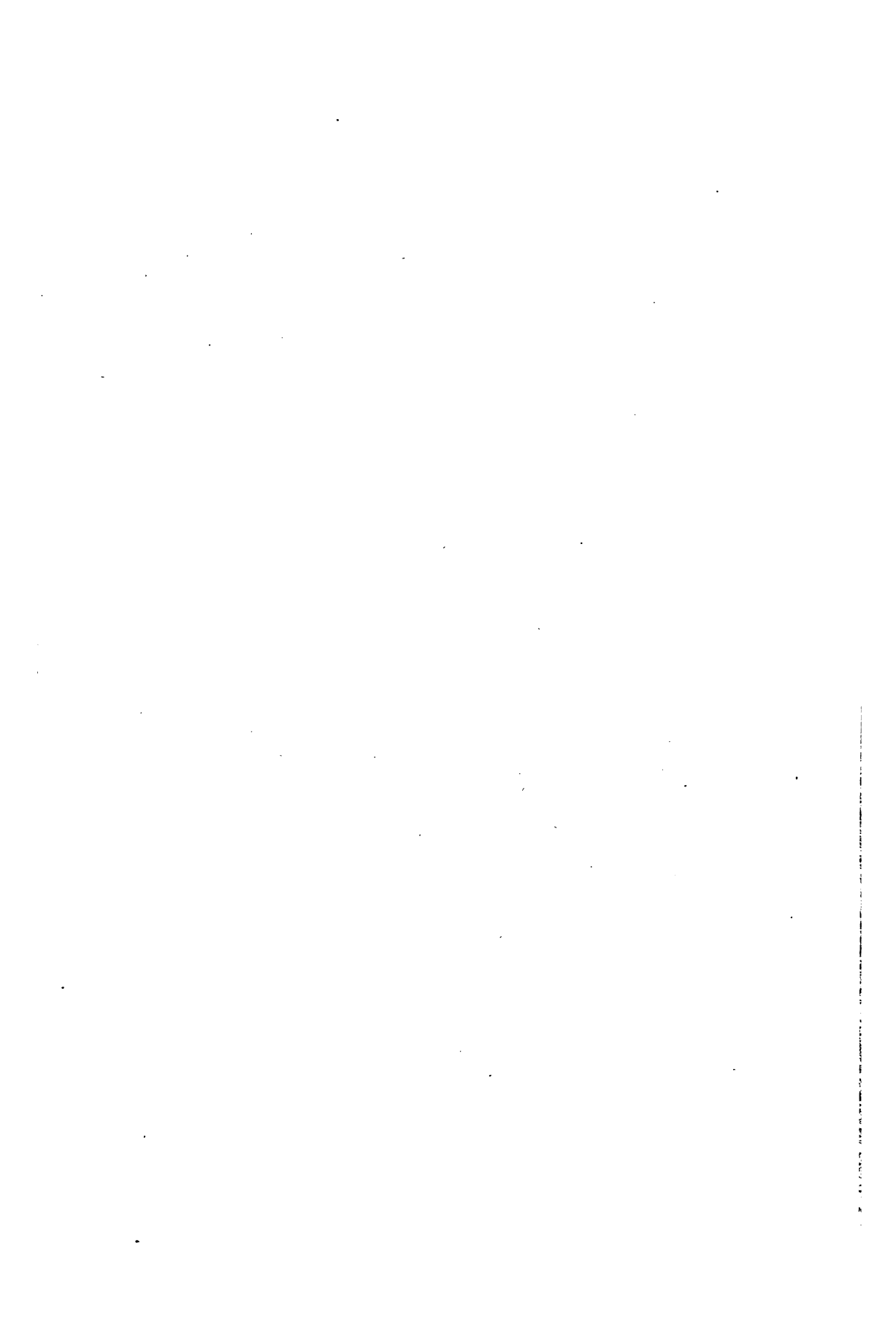
UNITED STATES HYDROGRAPHIC OFFICE CHARTS OF HAWAIIAN ISLANDS.

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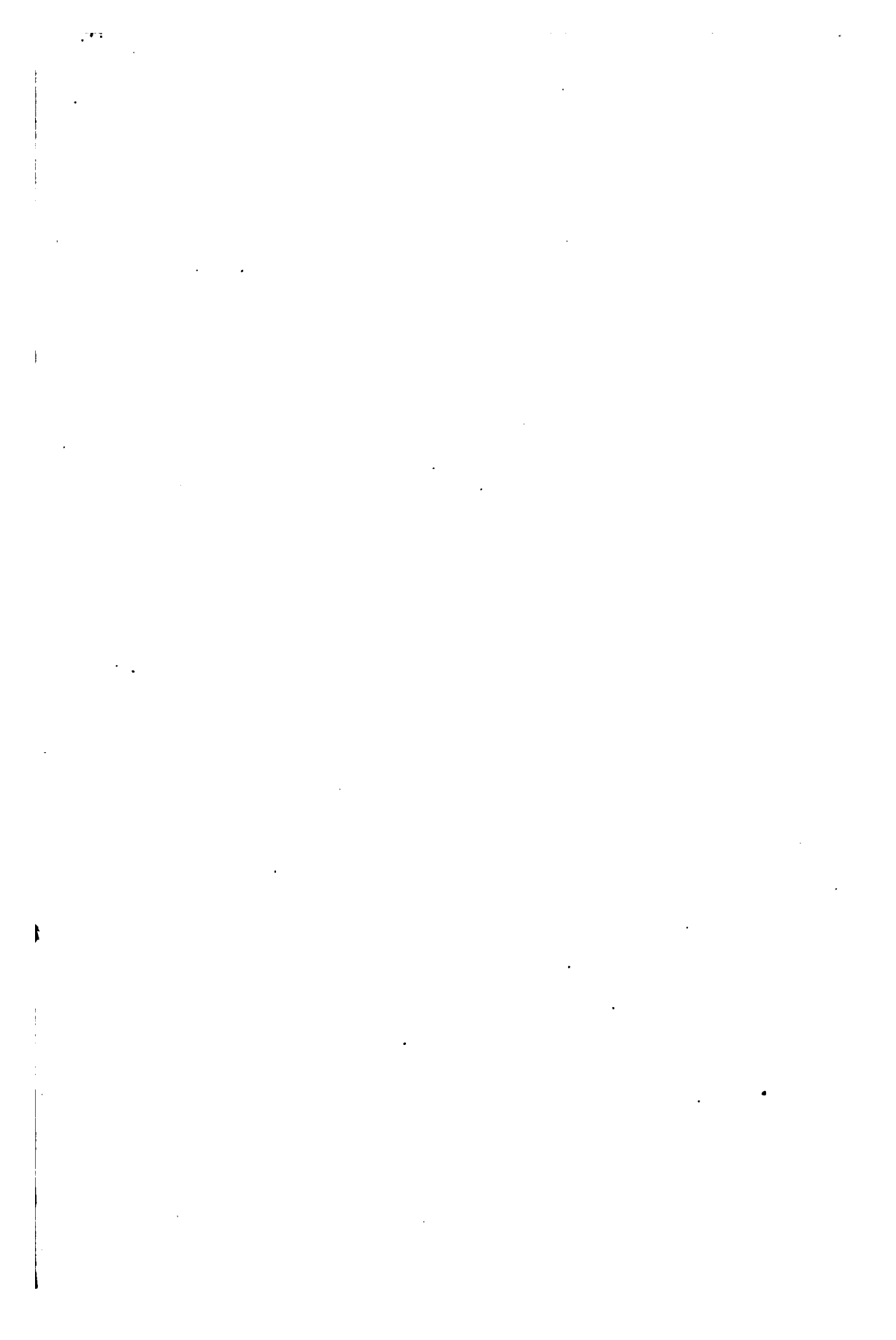
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